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THE ACUTE ABDOMEN

THIS morning I want to discuss with you a very important general proposition in abdominal surgery, that is the group of conditions with acute symptoms which have led to the coining of the term, "acute abdomen." I do not think that is a very good term, and still it is fairly generally used throughout the United States. Under the term "acute abdomen" we must consider all the conditions that may possibly produce the general symptom-complex to which we have given this term; in other words, our study this morning will be a study of the differential diagnosis between the very many conditions that produce these acute abdominal attacks.

I shall enumerate them in the order in which they appear to me to give rise to this clinical picture. On the whole, we must put appendicitis down first. Secondly, I would put down acute attacks developing from lesions of the bile tracts, gall-bladder, and bile-ducts. Probably in the third place, in the order of frequency, we would consider lesions of the kidney and ureter which give rise to acute attacks. In the fourth place, I should put down lesions of the stomach and duodenum. I would group the stomach and duodenum together because that would include ulcers both perforating and penetrating. Then we might put lesions limited to the female genitalia, the uterus, tubes, and ovaries, covering such acute conditions as acute salpingitis,

acute lesions of the ovary, extra-uterine pregnancy, and ovarian cyst with twisted pedicle. They would form a very large group of cases. I must at this point tell you what my old colleague Christian Fenger used to say. Fenger was one of the greatest surgeons that America has ever had. He was born in Denmark and he spent many years in pathology before he went into clinical work. He was surgeon to the Khedive of Egypt at one time, and about 1878 came to America. He was one of the very important factors in placing American surgery on a scientific basis from the standpoint of surgical pathology, and the principles of surgical diagnosis. I have often been in consultation with Fenger when the question involved was a differential diagnosis of some acute abdominal condition, as appendicitis, gall-bladder, right kidney, right tube and ovary, and I have several times heard him say as he puzzled with these cases, "yes, it is on that damn right side," meaning there were so many things on the right side that might give rise to this complex abdominal picture. Next to lesions of the female genitalia we might place lesions of the intestines and that would cover inflammatory conditions like tuberculosis, obstruction, and such things as tumors of both small and large intestine. That would give a very large field. Possibly the next in order would be lesions in the pancreas, acute pancreatitis. The liver and infrequently the spleen would have to be considered, with such conditions as abscess of the liver, echinococcus cyst, and gumma of the liver.

As examples of differential diagnosis in this group of acute abdominal conditions, I shall present a number of cases. The first patient is a man on whom I operated eight days ago. A week ago Sunday night Dr. Post called me and told me he had just sent a patient of his and of Drs. Arthur Elliott and Shipley to the hospital with an acute abdominal condition. I came over and found the man had been sick about forty-eight hours. He stated that the pain came on Friday night, and two hours later he vomited. He took $1\frac{1}{2}$ teaspoonfuls of salts and the bowels moved. Saturday morning he went to business and stayed until about 12.30. Then he went to see his doctor, who told him that it was some intestinal upset, and to go home, eat

lightly, and let him know if anything happened. He went home and stayed in bed in the afternoon. That night he went to a dinner party, returning home about midnight. He had some pain the latter part of the evening and on his return home took castor oil, after which the bowels moved freely. He continued to have more or less pain in the stomach. He stayed in bed Sunday morning, and kept a hot pad over the abdomen, which gave him some relief. In the afternoon he got up and went out to make a call. About 3.30 P. M. the pain recurred in spasms and he sent for the doctor about 5 P. M. He was sent to the hospital about 6 o'clock and operated on about 8 o'clock. At operation I found a great, huge appendix, a great deal thicker than my thumb, in the angle between the cecum and lateral abdominal wall. It was covered by a plastic peritonitis so that the appendix was buried completely. I could not see the appendix at first, but as I enlarged the incision and put in some retractors I could see the cecum and a longitudinal band of muscle on the cecum which always leads down to the appendix, terminate abruptly, and as I followed that longitudinal band I could not see any appendix behind that. I separated the appendix gently from the parietal wall and out came ½ ounce of pus. I ligated off the mesenteriolum, the little mesentery of the appendix. The cecum was very friable and edematous, so I just tied off the appendix with a firm piece of catgut and cut it off close to the cecum. I could not invaginate the stump of the appendix. In the appendix was a perforation. I put in a couple of drainage-tubes and closed the abdomen. He is going on to an excellent recovery.

Let us interpret from the very definite chronologic order the things that happened in this patient's case in view of the knowledge that we have obtained from the clinical picture and from the pathologic condition found at operation. What happened beyond any question was that when he began to have pain he had a very severe acute attack of inflammation in his appendix. The appendix became swollen and was obliterated at one point completely. The inflammation was undoubtedly from the usual causes, a combination of colon, streptococcus, or staphylococcus.

The caliber of the appendix distal to the point of obstruction had become distended. It occupied the gutter between the cecum and the abdominal wall. He had a good deal of pain, and then he took these cathartics, which were very bad things for him to take because anything that increases peristalsis like a cathartic would be apt to increase the risk of perforation. On the whole he was in pretty good condition because he had been a man in good health. He went to the dinner party Saturday evening, and went out on Sunday afternoon, and when he came back he had a great deal of pain. What happened Saturday and Sunday was this, that the appendix was walled off by a reparative plastic peritonitis from the general peritoneal cavity. Sunday afternoon that appendix became greatly distended and it perforated. By that time it was pretty well walled off from the general peritoneal cavity, so that he was saved from a case of general peritonitis. The pus was prevented from passing into the general peritoneal cavity because of that general plastic peritonitis. By the time he was brought into the hospital the perforation had occurred and that ½ ounce of pus was formed around the appendix, and some additional pus was found right in the appendix itself after the appendix perforated. He even thought that the doctors were railroading him into an appendix operation. When I came over to see him there was no question about the diagnosis because we got a very clean-cut clinical history. He was exquisitely tender over the appendix. He was a little sore over the rest of the abdomen, but with harder pressure, he had no such exquisite tenderness as he had over the appendix. His temperature was 102° F., pulse was good, about 80, and leukocyte count 13,000. In addition to this, we made an examination of the urine, and it was negative, which was an argument against there being any lesion in the urinary tract such as a ureteral stone. I had no hesitation in telling him at once that it was an acute attack of appendicitis and that he should be immediately operated on. I said that quite definitely and quite clearly because the theory of probabilities made that diagnosis in 99 out of 100 cases correct, and knowing that it was five or ten times safer to operate on him than to leave him alone, Dr. Post, Dr. Elliott,

and myself had no hesitation in urging him to be operated. There is a golden rule in surgery that you do not want to do an operation on a patient unless you are quite convinced in your own mind that if you were the patient and the circumstances were the same, you would want to be operated upon. In a case like this, the risk of not operating on him was enormous because sooner or later he might have had a general peritonitis.

The second case which I shall show you as an example of differential diagnosis in these cases is a woman of forty, married, who came in with the following history:

She came to my office with pain in the left lumbar region. Five years ago she said she had her first attack of sharp pain in the left lumbar region which radiated down to the left lower quadrant, and after that she was perfectly well until seven days ago. Seven days ago, about 3 P. M., she had a knife-like pain which suddenly appeared in the right lumbar region, radiating to the upper and lower quadrants, around the back to the mid-spinal area. For seven days the pain has been present, though not as severe. It has no relation to meals. She said that six or seven days ago the urine was very dark reddish-brown in color. There was no pain associated with urination and no burning sensation. The urine gradually cleared up. The lower extremities were slightly edematous. Physical examination showed no definitely localizing evidence except her own reference to pain. The assistant who took the history put this down as a working basis for differential diagnosis—renal calculus, tuberculosis of the kidney, pyelonephritis, and tumor of the kidney. We sent her into the hospital. Blood findings showed 90 per cent. hemoglobin, 9000 white cells, blood-pressure 124/78. The urine examined in the hospital showed no blood. On the basis of the clinical picture we had some *x*-rays taken. There was a good deal of gas in the bowel and nothing else; the intestines were normal. There were two indefinite shadows, one at the transverse process of the third lumbar, about the size of a coffee berry, and which is probably a calculus in the left ureter. On the other side there is a shadow in the right kidney, which is

presumably the lesion that gave the clinical picture five years ago of acute kidney colic.

I cannot tell you exactly our views about this, but for the patient's benefit, and comfort I will say that we are not going to operate on this case at this time. A coffee-berry sized stone may pass through the ureter. That is the stone that has given the trouble in the last attack because the symptoms have been upon the left side. It is possible that we shall not operate upon the stone in the right kidney, certainly we shall not operate at all at present. We are going to send her home and keep her fairly quiet. She is rather heavy, and we are going to put her on a diet that will make her lose about a pound a week. We are going to have her drink a pint of water at bedtime with the idea of diluting the night urine which inhibits as much as anything we can do stone formation, and then we are going to have her report to us later. One other thing we may do. We may inject oil into the ureter with the hope that it will assist in the passage of the stone. There is certainly 75 to 80 per cent. chance of this patient's passing this coffee-berry sized stone from the left ureter.

I have for years used the term "coffee-berry" sized stone, because I may be called on to operate on a ureteral stone that will be no larger than a good sized coffee-berry and I know from my experience in a good many cases that most of these will pass. The mere presence of a stone in the kidney does not demand immediate operation. A surgeon who would operate upon this patient now without further observation, I think, should be properly criticized. Stones in the kidney are by no means uncommon. Several years ago in discussing this subject with seven other doctors at a luncheon, four of them stated that they had passed kidney stones, and none of them had been operated on. I cite that little concrete incident because it represents what is a fact, that the great majority of these cases do not require operation. Another point which has to be considered in this woman's case is that she has bilateral kidney stone. The indication for operating on bilateral kidney stone is relatively not positive. Wise surgeons and surgeons of large experience do not operate on a patient with bilateral kidney stone. We very often leave these

cases severely alone unless operation is definitely demanded. We are very much more apt to operate on a case of kidney stone where there is only one kidney involved.

The next case represents a third type of acute abdominal lesion. This patient was sent in as an acute gall-bladder case for immediate operation. She is a woman of thirty-nine, whose trouble began a day or two ago with pain in the right side, radiating into the abdomen, temperature of 103° F., and nausea for twenty-four hours. There was no pain on urination, no hematuria. She had no pain in the chest and no productive cough, other than a severe pain on inspiration. She had a severe pain in the abdomen, and her physician sent her in as an acute gall-bladder case, possibly an empyema.

A very careful examination of the lungs showed fine crackling râles, dulness, and increased vocal and tactile fremitus. Her temperature has varied from 102° to 101° F.; leukocytes 26,000 with 74 per cent. hemoglobin. Blood-pressure 110/74. There were some pus-cells in the urine, but no casts. Another examination of the blood showed 4,600,000 red cells and 24,000 leukocytes. I am not prepared to give you a definite diagnosis, but my assistant put it down as a right lobar pneumonia, and had her transferred to the medical side. She has since had bloody sputum.

Of course with a history some months before of an acute abdominal attack promptly relieved by morphin, no one can blame the doctor who saw her in this attack from making a diagnosis of acute gall-bladder. I introduce this case to emphasize this important fact that many cases of pneumonia give one a clinical picture of an acute abdominal attack. I remember the grandchild of ex-Governor Dunne who was under Dr. Grulee's care here in the hospital, and was seen by Drs. Herrick and Kretschmer. A probable diagnosis was made at first of intestinal obstruction or appendicitis. The little child was blown up, had a perfectly rigid abdomen, a lot of abdominal pain, and vomiting. Some of my associates thought it was an appendicitis. I felt in a rather intuitive way that it was not at that time a surgical case, but should be kept under observation. The leuko-

cyte count was very high, the respirations high, and the whole picture made me think of the possibility of a lung lesion. I excluded intestinal obstruction because in spite of the vomiting there was good bowel movement with injections. The matter went on for a number of days without any definite diagnosis and finally I found the right chest flat, put in an aspirating needle, and found pus. The empyema was drained, and the child went on to recovery without ever developing any evidence of any abdominal lesion proper. But the picture was distinctly that of an acute abdomen. It sometimes is difficult in a young child to make a diagnosis of pneumonia, more so than in the adult. I cite that case because it was seen by very competent men; and a number of possibilities were discussed. It appeared to me in an intuitive way that it was not an intestinal obstruction, and probably not an appendix. What do I mean by an intuitive way? After you have seen 100 cases of acute abdomen from many causes, and have studied them carefully, you naturally somewhere in the gray matter in your brain acquire a composite photograph of the 100 cases. When you see another case, that composite picture made up of those 100 different pictures comes to your mind, and that is what is known as experience. When that grows to 500 or 1000 cases that composite picture becomes a very important aid in diagnosis. The composite photograph comes to your mind so quickly that it is almost like intuition. It is not after all intuition. It is a rapid mental process that is backed up by that composite photograph which in turn, is made up of 500 or 1000 clinical pictures. It will be easier to make a diagnosis after you have actually handled many of these cases. It will be very much easier to make a differentiation between intestinal obstruction, and appendicitis with perforation after you have handled several hundred cases of appendicitis, and several hundred cases of intestinal obstruction. You want to realize that because of the clinical observation of so many cases you get a composite photograph which becomes a most important part of your capital. That comes from a careful history taking, careful physical examination, careful operating, and careful postmortem or operative findings.

In addition to the cases which I have presented to you today, I shall give you briefly the histories of a number of other cases which have presented this clinical picture of acute abdominal attacks which we have had on our service in the last few months.

A young woman of thirty was brought to the service in an acute abdominal attack. She had intense pain, and evidence of an infective process as shown by an increased leukocyte count, and increased pulse-rate, and a rigid tender abdomen. She was seen both by myself and one of my gynecologic colleagues; in fact, she was first admitted to the Gynecological Service and transferred to our service as being a case of peritonitis probably arising from an appendix lesion, or a case of intestinal obstruction. She had a partial paralytic ileus, difficulty in obtaining expulsion of gas, and marked tympany. When I examined her, I thought I could feel a mass on both sides of the uterus. There was no definite evidence of a neisserian infection, but this possibility could not be excluded. Analyzing the case, I thought that I could exclude such lesions as appendicitis and cholecystitis, mechanical ileus, and I made a clinical diagnosis of probable neisserian infection of the tubes and advised against an exploratory operation.

I was out of town for a day or two and during my absence, my gynecologic colleague had one of my associates called, and he operated upon the woman and found a fibrous peritonitis involving the pelvis and the tubes on both sides, clearly a neisserian infection. He introduced a drainage-tube, which was left in but a short time, and then removed. Following this exploratory she developed a lot of adhesions about the site of the drainage-tube and a mechanical ileus, so that it was necessary to do an ileostomy to save her life. Later an operation was required under local anesthesia to close this ileostomy opening. She then went on to a full and complete recovery.

I cite this case because I am certain that it is much better not to operate at all in most of these cases of neisserian peritonitis as a rule, because under rest, a bland diet, keeping the bowels open with mild salines, and either ice-packs or hot-packs, they go on to recovery in the great majority of the cases without the necessity of any surgical interference.

The next case I want to present to you is one in which a woman of fifty was brought to the hospital in intense pain and vomiting, with a rigid abdomen, a partial paralytic ileus, a temperature of 102° F., and a leukocyte count of 20,000. I was puzzled the evening that I saw her and thought that it was wise to watch the case and await developments until the next day. I then did a midline laparotomy under the sequence of ethylene and ether, and found some fluid fibrin in the pelvis and in the lower abdomen, and the appendix, which I removed, buried in fibrin. I found deep in the pelvis a small fibroid tumor with a long pedicle. This pedicle was twisted so that the blood-supply was cut off and the tumor, which was about the size of a lemon, was necrotic. This was removed, and the abdominal cavity drained. Unfortunately in this case, the same sort of infection that was present in the peritoneal cavity, a combination of streptococcus and colon, invaded the abdominal incision, and produced a rather extensive suppuration from which, however, she went on to recovery at the end of three or four weeks.

The next case that comes to my mind is one of a colleague of mine who called me to see him in a very acute abdominal attack. He was satisfied that he had a diverticulitis of the sigmoid and insisted upon an immediate operation. After analyzing all the facts in the case, I felt quite certain that he was suffering from the passage of a ureteral stone on the left side. There was very little temperature, and very little increase in the leukocyte count. There was great pain, great tenderness, slight rigidity, there was an absence of anything abnormal in the urine, but I felt that this could be explained in his case as it is in a number of similar cases by the fact that the stone had completely blocked the left ureter so that all the urine that was coming down into the bladder came from the normal right kidney. It was with great difficulty that I dissuaded him from having an immediate operation, and he finally called in another consultant who took the same point of view that I did. The *x*-ray pictures did not show any stone but within a few days he had blood in his urine, and within a week, passed a small ureteral calculus into the bladder and he passed it per urethram.

The next case that I shall show you is this lady, who is in my service at the hospital and upon whom I operated eight days ago. She came in with a very acute abdominal attack. The pain was quite general, the abdomen was rigid. She had marked tenderness all over the abdomen, but especially in the right upper quadrant. The temperature was 101.5° F., the leukocyte count 18,000, and the urine was negative. We made a clinical diagnosis of acute gall-bladder lesion with a local peritonitis about the gall-bladder. At the time of the operation I found a markedly distended gall-bladder with gangrene of the fundus, the gangrenous area being about the size of a silver quarter. There was one large stone as large as a good-size plum in the gall-bladder. There was nothing in the cystic duct or in the common duct. This woman is very stout and her general condition is not good. I decided not to remove the gall-bladder, but simply to remove the gangrenous area and the single large stone, and drain the gall-bladder.

In this case, of course, we were confronted with such an acute condition that we operated immediately, as soon as she was brought to the hospital. We did not delay matters even to get a flat plate or a Graham test. You see she is going on to a very good recovery. The gall-bladder will be drained for fifteen to twenty days, and then the tube removed.

A few months ago I was called one night to the hospital by one of my medical colleagues to see a man of about fifty-five whom he thought had a perforating peptic ulcer. I found a man who had for some weeks been drinking heavily; he had been playing golf that afternoon, and after the exertion, vomited up a large amount of blood, and then passed into a condition of shock with intense pain in the abdomen. I do not think I have ever seen a more rigid abdomen. The entire abdomen was as hard as wood. The man was having intense pain which was only partially relieved by large doses of morphin given hypodermically.

I felt that the case was not typical, but that it probably was a perforating peptic ulcer either in the stomach or in the duodenum. Therefore, under ethylene I made an exploratory operation, and found the peritoneal cavity perfectly clean, no evi-

dence of peptic ulcer, and no evidence of duodenal ulcer or lesion of any kind. The incision was immediately closed. He died inside of twenty-four hours, and fortunately we obtained a postmortem and found that the lesion was not intra-abdominal, but intrathoracic. A rupture of the esophagus was found about $\frac{1}{3}$ inch above the diaphragm. This rupture was about $1\frac{1}{2}$ inch long and the mediastinum and the chest cavity were full of vomitus, blood, and acute inflammatory exudate. The cause of the rupture was difficult to explain. I looked up the literature with a good deal of care, and it was difficult to say whether this rupture of the esophagus was due to a peptic ulcer of esophagus just at its lower point above the stomach which had given way and perforated (cases of this kind do occur), or whether it was a rupture of the walls of the esophagus from the very severe vomiting, or whether it might have been a rupture of the esophagus at the point where there were some varicose veins which involved the wall so that they gave way after the violent vomiting and hemorrhage. It was again an example of a case with a very acute abdominal attack in which the lesion was above the diaphragm, and not in the peritoneal cavity.

Another case somewhat similar to this in the sense that the lesion was not in the abdomen is the one which I shall next refer to, the case of a man with an acute abdominal attack in whom the *x*-ray picture showed stones in the gall-bladder and in whom an operation was done for the removal of the gall-stones. A short time later the postmortem showed that the lesion which produced the symptoms was a coronary thrombosis with extensive injury, and thinning of the heart wall due to this vascular accident.

A few months ago one of my colleagues on the pediatric side asked me to see a child of four years of age with an acute abdominal attack. I was uncertain as to the diagnosis. I saw the child about 9 o'clock one morning and studied the case; I thought we should keep her under observation for a short time. I saw her again at 11 o'clock with my surgical colleague who had had a large experience in the Children's Hospital, and he thought that it might be a case of intussusception though it did not show the

classical typical symptoms of such a condition. The symptoms had evidently become severer in the two hours we had had her under observation and I decided to operate.

At the operation which I did by a muscle-splitting incision on the right side, like an incision for removal of the appendix, I found an intussusception in the ileum. This had extended into the cecum. With some difficulty we disinvaginated the intussusception without fortunately doing any injury to the gut. As the cause of the intussusception we found a cyst about as large as a good sized cherry on the side of the wall of the ileum, and this cyst had gradually by peristalsis been invaginated into the ileum and up into the cecum. There was no blood in the stool. There was no definite tumor to be outlined. There was, however, more or less of a sense of resistance in the ileocecal region which helped, with the age of the patient, to make a probable, and what proved to be an accurate clinical diagnosis.

The next case I have in mind is the wife of a medical colleague who was seized with violent acute abdominal pain. I was called to see her at night. I was uncertain as to the diagnosis. It seemed to me that it might be a case of perforation with a beginning peritonitis or else a very acute case of intestinal obstruction. At laparotomy no perforation was found, and no evidence of obstruction, but the tell-tale whitish-yellow plaques of fat necrosis in the omentum, and in the mesentery which are so characteristic of acute pancreatitis were found. The pancreas was not much swollen. There seemed at that time to be no indication to operate on the gall-bladder, and the abdomen was closed. Fortunately, the patient went on to a recovery. Later symptoms of gall-stone colic developed, and after removal of the gall-bladder she went on to complete recovery.

A short time ago my colleague, Dr. Post, asked me to see a patient of his, a woman of about forty-five with what he regarded and with what I regarded as an acute gall-bladder. The woman had had several attacks of severe pain in the right upper quadrant. There was a round lump to be felt in the region of the gall-bladder which was quite tender. The evidence seemed to be so definite and complete that no Graham test was made. I op-

erated at once, and found instead of a gall-bladder, a large gumma of the liver right close to the gall-bladder, and a number of stellate scars in the liver, the site of healed gummas. The abdominal incision was closed and she went on to a very good recovery under antispecific treatment.

One of my colleagues called me in consultation in a case of one of his patients at the Presbyterian Hospital who came in with a very acute abdominal attack. The man was evidently suffering intense pain, and the diagnosis seemed first to be probably that of an acute gall-bladder, but on careful analysis we were able to obtain very definite evidence of tabes and a very definite history of syphilis. In watching him through the attack we were able to make quite positive a diagnosis not of any surgical lesion, but of a gastric crises of tabes. One must be on his guard in cases of this kind to avoid doing an unnecessary operation. On the other hand, we must remember that individuals who have tabes may also have gall-stones, and that occasionally, gall-stone attacks in a tabetic are misinterpreted and are regarded as a gastric crises when as a matter of fact they are definitely due to cholelithiasis and are cases which should be operated upon.

Recently on the service we had a man brought in with an acute abdominal condition which was difficult to analyze. He was exquisitely tender in the left upper quadrant, extending down to a line drawn through the umbilicus. He had temperature, a high pulse, increased leukocytosis, and a sense of resistance. We watched him for a few days, and then operated upon and came down, after opening through the abdominal wall, to a large abscess of unknown causation and anatomic location. We had to satisfy ourselves with simply draining the abscess. The patient improved for a short time, and then a rather large fistula persisted at the site of the drainage tube. The acute symptoms recurred and another deeper abscess was opened and drained. The patient improved after the second operation for a few days, and then had a rather severe hemorrhage and died. Postmortem showed an abscess of the spleen with streptococci and staphylococci. The spleen was enlarged and a large part of it was de-

stroyed by the suppurating process. We were never able to determine definitely the exact etiology of this case. It may have been a septic infarct from some unknown focus.

Another acute case that comes to my mind is that of a woman whom I operated upon recently in an acute abdominal attack. She was seized in the middle of the night after a late supper with intense abdominal pain, colicky in character, situated low down in the abdomen, and more to the left side. The attending physician who was called thought that he could feel during the attacks of pain a stiffening of the gut as though it was in violent peristalsis. I was called early in the morning. She was sent to the hospital and we made a probable diagnosis of intestinal obstruction due possibly to adhesions which followed a pelvic operation which had been performed for uterine fixation about a year before.

On opening the lower abdomen I found the sigmoid a loop about 18 inches in length that was a very dark purple, and was caught between the uterus, "which had been sewn to the anterior abdominal wall in the former operation," and the abdominal wall. I found that the fundus of the uterus was fixed very firmly to the abdominal wall just above the bladder by a rather strong adhesion about an inch long and as large apparently as my little finger. I divided this and in it I found a large massive silk ligature which I removed. After dividing this adhesion I was able to bring the sigmoid loop out through the abdominal incision and pack it around with moist packs and finally I put it back in the abdominal cavity. After watching it for about ten minutes, I found the circulation was returning, and that there was no danger of gangrene and so I closed the abdominal incision without any danger. Fortunately, she went on to a very good recovery.

Another recent case illustrative of these acute abdominal attacks occurs to me. The patient is a colleague of mine in the University who was brought to the hospital in a very acute abdominal attack. He had apparently been in excellent health until this attack occurred. The pain was very severe in the left lower quadrant. Examination of the rectum showed nothing palpable as high as my finger could pass. There was,

however, a stiffening of the gut, apparently the sigmoid, during the colicky attacks, and the attending physician who first saw him sent him to the *x*-ray room, and put a little barium solution into the rectum and obtained a very good fluoroscopic picture of a very definite obstruction about 8 inches from the anus, showing that we had to deal with a small circular carcinoma just above the rectosigmoid junction. A colostomy relieved the obstruction.

One of the most important acute abdominal emergencies with which we have to deal is that of perforating gastric or duodenal ulcer. A short time ago, a young man in his early thirties, who had been with the American troops in France during the war, was seen by one of my colleagues in internal medicine in a very acute attack. He was seen within a half hour after the attack began. He was in great pain. His abdomen was very rigid—a board-like rigidity. He had no temperature, and no increased leukocyte count. He was in shock. Before he went into army service, he had what had been diagnosed as duodenal ulcer. After he joined the army, however, these symptoms entirely disappeared. He had been well for a number of years. Urine examination showed nothing abnormal. Physical examination of the abdomen showed the upper abdomen more rigid than the region of the appendix.

I was called and immediately sent him to the operating room and made an exploratory laparotomy under ethylene. I found on the anterior surface of the duodenum about $\frac{1}{3}$ inch from the pylorus a perforation about the size of a good size quill toothpick. Through this perforation there had escaped $\frac{1}{2}$ or 1 dram of intestinal contents. There was no bleeding. I closed the perforation with two purse-string sutures of moderately fine catgut. The perforation was so small that an invagination of the duodenal wall at the site of the perforation did not produce enough narrowing to cause any obstruction. I, therefore, did not do a gastro-enterostomy. If the repair of the perforation had produced enough narrowing to make it at all probable that an obstruction would occur, I would have immediately done a posterior gastro-enterostomy. My experience has been that after

perforation a great many of these ulcers heal, especially if proper ulcer management is followed for a number of weeks. I do not, therefore, think it wise to insist upon the making of a gastro-enterostomy in all of these operations, but to decide in a given case as to whether there is or is not enough obstruction produced by the ulcer and its repair to demand it.

This patient went on to a very normal and complete recovery. He was operated on a few hours after perforation occurred. The time element in these cases is of enormous importance. Cases operated upon early, as in this case, almost all go on to recovery. Cases that are not operated on until after twenty-four hours have a mortality approaching 50 per cent.

Another very interesting problem in acute abdominal work I have now under observation. A man of sixty-three, an old personal friend of mine, was out duck shooting. I had operated on him five years ago for obstruction at the pylorus and for duodenal ulcer, and made a simple posterior gastro-enterostomy. He recovered well from the operation, but has had two hemorrhages since, about a year apart, which necessitated hospital care for several weeks. He has had a blood-pressure from 180 to 230 for some time. While duck shooting where he had exerted himself somewhat walking over some rather rough country, he was suddenly seized with intense and very severe pain in the pit of the stomach. He collapsed and passed at once into a condition of severe shock, and was brought back to the club house with some difficulty. A physician was secured who gave him hypodermics of morphin and some nitroglycerin. He improved so that within twenty-four hours he was able to manage an over-night trip back to his home in Chicago.

A physician was called who found that his blood-pressure had gone up to 250. I saw him in consultation when he was brought back to Chicago. He had intense pain especially in the back. He was somewhat tympanitic and vomited somewhat. His blood-pressure varied from 160 to 230. A number of things were considered in his case, but on account of the condition of his blood-vessels—he had advanced arteriosclerosis with high blood-pressure—I was inclined to believe that it was a vascular acci-

dent of some kind. He had no blood in his stools. His hemoglobin and blood condition remained about as they were before the accident. He had little temperature and no leukocytosis. We considered a bile-tract lesion, penetrating peptic ulcer, dissecting aneurysm, and apoplexy of the pancreas. After watching the case for about three weeks I came to a fairly definite clinical diagnosis of hemorrhage in and about the pancreas; on the basis of the clinical picture and by a process of exclusion nothing developed pointing definitely to a bile-tract lesion or hemorrhage, or penetration or perforation of a peptic ulcer, or intestinal obstruction. The sudden onset and severity of the pain in the abdomen, and especially the great pain which he had in his back, the absence of temperature and leukocytosis, the fact that he became slightly jaundiced, the fact that he had marked arteriosclerosis and high blood-pressure, I felt all pointed with more certainty to an apoplexy of the pancreas than to any other lesion. It was clearly a case inwhich one could not make a definite diagnosis without an exploratory operation, and an exploratory operation was certainly contraindicated.

I have presented these cases to you because they illustrate the problem of the acute abdomen as it arises in an active hospital service. These cases illustrate what a great variety of conditions are capable of producing this symptom-complex, and must be considered in making a differential diagnosis in the specific case which confronts us. The most expert diagnostician and clinician must be satisfied with making not necessarily a complete and absolutely accurate diagnosis in cases of this kind, but must be satisfied with determining whether or not an exploratory operation should be made in that individual case, and that is, after all, our real problem.

Now, then, on the basis of these examples let us discuss the differential diagnosis in these acute abdominal attacks. To begin with I shall make this general statement that in this differential diagnosis certainly more than 80 per cent. of the evidence of value in determining the diagnosis is obtained in a very simple way by a very carefully obtained history, properly interpreted, and by a thorough physical examination. Remember in ob-

taining the history of this comparatively simple case of acute appendicitis I insisted upon the importance of one thing first, namely, pain. It was not a matter of diarrhea, nausea, and vomiting; the first thing this man had was pain. You want to learn how to take a history accurately and to interpret it properly. In the second place you want to learn how to use your five senses, especially your eyesight, your hearing, and your fingers. In addition to the evidence obtained from the history and from the physical examination, there are other sources of great value. These are the evidences that one can obtain in the clinical and pathologic laboratory and in the *x*-ray laboratory. These include such evidence as we may obtain from an examination of the blood, from a Wassermann reaction; such evidence as we obtain from an examination of the blood that would give a picture of leukemia; in a big abdominal tumor sent to you for operation which proves to be nothing unusual, but simply a leukemic spleen; such evidence as we obtain from the microscopic examination of tissues and fluids as to the presence of actinomycosis or tuberculosis in a given case; examination of a piece of tissue removed for microscopic examination such as I have suggested in the man's case I showed you yesterday, to determine whether the enlarged glands of the neck were carcinomatous, tuberculous or syphilitic, or a malignant lymphoma. You cannot underestimate the value of these laboratory findings. Finally, the *x*-ray findings; they are of very great value in making a differential diagnosis in acute abdominal conditions. The *x*-ray findings that we obtain sometimes on a flat plate in the case of distention of the bowel; the information we obtain with a barium meal; the information we obtain in a kidney stone case are all of great value. The examination that we obtain in the clinical laboratory with a Graham test is also very important in arriving at a clinical diagnosis, which, after all, is simply the working hypothesis, as Claude Bernard used to say. If you have not read his little book on "Experimental Medicine," take the time to do it. It is one of the most instructive pieces of work that you can possibly read. Claude Bernard in his wonderful work both as a laboratory man and a clinician lays down the

rule that in experimental medicine you must start with a working hypothesis. That is what we do in clinical medicine. Our clinical diagnosis is a working hypothesis. It is not by any means final. In arriving at this clinical diagnosis, which will be sufficiently definite for us to base surgical therapy on, we have another thing that we must do, that is, we must take into consideration the theory of probabilities. Let me give you a conception of what I mean by the theory of probabilities as applied to these acute abdominal attacks. Here is a boy of fourteen with an acute abdominal attack on the right side coming on suddenly. He may have a symptom-complex consistent with three or four things, but he is fourteen years old, and we can with a great deal of probability exclude gall-stones, because boys of fourteen seldom have gall-stones. You cannot with any very positive certainty exclude the same things in a woman of thirty with an acute abdominal attack in which the lower quadrant is involved. It might be some lesion of the tube or ovary. A high lying attack in a woman of thirty, especially if she has children, would point to the probability of gall-stones. I do not mean that you can exclude the appendix. You would have to include gall-stones because 80 per cent. of the gall-stone cases occur in women who have had children. Pregnancy is the overshadowing factor in the production of gall-bladder disease. In a man of thirty with an acute abdominal attack in the right upper quadrant of the abdomen, the theory of probabilities points to a penetrating or perforating ulcer because they are common. You must also include gall-stone disease, and appendicitis because they might occur in such a patient.

In making these differential diagnoses there is another very interesting process one must go through in arriving at a working clinical diagnosis on which you base your therapy, that is, the process of exclusion. You arrive at a rather general working hypothesis that this man has an appendix lesion, but you want to exclude other things; you want to exclude ureteral stone. You examine the urine and you find it negative. You take a flat plate of the genito-urinary tract, and find no evidence of stone. You do not exclude with absolute certainty stone, tu-

berculosis of the kidney, ureteral stone, but with a perfectly negative urine and with a flat *x*-ray plate showing no evidence of stone, you would say in weighing the evidence that it is probably an acute appendicitis and be rather satisfied that it is not a kidney or ureteral lesion. Of course in very acute conditions you do not want to employ any method that might have an injurious effect on the patient. We never in an acute abdominal case consider using the Graham test. We might do such a thing as take a flat plate, but to submit a patient who is in agony with an acute abdominal condition to the Graham test would be extremely bad surgery and extremely bad judgment. So this process of exclusion must be very carefully taken into consideration.

In making these differential diagnoses you want to realize that no surgeon no matter how brilliant he may be or how much experience he may have had, approaches anything like 100 per cent. accuracy. My old friend, Dr. Sippy, and myself did for years a piece of joint clinical research in abdominal cases. We did team work in which we called to our assistance the *x*-ray laboratory, the clinical laboratory, the pathologic laboratory, and the men in other specialties who could assist us in making these differential diagnoses. My own conclusion was that we arrived at an absolutely correct anatomic and pathologic diagnosis in somewhere between 80 and 90 per cent. of our cases. We knew very well when we operated on a man of fifty, or a woman of fifty with gall-bladder disease we might find cancer, because we knew that 10 per cent. of the patients with gall-stones over fifty are found to have cancer. We always take that into consideration. We knew perfectly well that it was impossible to always differentiate between acute gall-bladders and penetrating ulcer. How did we know that? Because in the fifty or one hundred times we had that problem we sometimes found acute gall-bladder with gangrene or perforating and sometimes penetrating ulcer. We knew that both of these conditions could produce a symptom-complex resembling one or the other. We knew perfectly well that we sometimes made a diagnosis of gall-stone disease when we had to deal with a high lying appendix.

We learned another thing, that we sometimes had both conditions in the same patient. It was not at all impossible to operate on a case of acute appendicitis and find a gall-bladder acutely inflamed and full of gall-stones. We knew perfectly well the difficulties in making a differential diagnosis between perforating ulcer of the duodenum, acute pancreatitis, and acute gall-bladder, and a case of intestinal obstruction. The difficulties are very great. We knew that we would sometimes make a diagnosis of perforation of the duodenum and we would operate and find an acute pancreatitis with fat necrosis. There is this comforting fact, that in a much larger proportion of cases than the 80 to 90 per cent. of correct diagnoses, you will find other acute conditions which, although they differ from the diagnosis which you have in mind, are conditions for which the patient should have an operation. When Sippy and I would make a diagnosis of acute gall-bladder or perforation of a duodenal ulcer and would find an acute pancreatitis, we would not feel badly because we knew that that case of acute pancreatitis should be operated on. When we made a diagnosis of perforating duodenal ulcer and found a perforating gall-bladder, we did not feel badly because we knew that that acute gall-bladder should be operated upon. So that after all, in modern work, the percentage of error of operating on these acute abdominal cases where no operation should be done is quite small, somewhere between 2 and 5 per cent., very seldom more than 2 per cent. For instance, I operate upon a woman and I think she has an acute appendix. I find that she has not an acute appendix, but she has an ovarian tumor with a twisted pedicle, with the tumor becoming necrotic. I do not feel badly at all; I remove the tumor, and know that I have done a good piece of surgery. Of course, I am taking this point of view that we are discussing work done by a thoroughly competent surgeon, a surgeon of experience and good judgment, controlled by the highest standard of medical ethics. There is no doubt, I am sorry to say, that a great deal of unnecessary operating is being done all over the world; that men of little experience and of little training, men who are not governed by the Golden Rule in surgery are doing a very large amount of unnecessary

operating. It is a very common experience for me to have a patient brought to me with the request that I make an examination, and find if I can determine the correct diagnosis in the case. After excluding as best I can, such a condition as appendicitis, and assuring the patient or the parents, if it is a child, that he has not appendicitis and does not require operation, it is a very common experience to have him say, "Dr. So and So examined and urged me to go to the hospital immediately and have my appendix out." That may be, but there is no question about the fact that the patient did not have appendicitis and that the man was mistaken who recommended operation. That is explained on either the grounds that the man is not a properly trained clinician, is ignorant, or has poor judgment. Some men have a bias or an obsession in surgery for doing certain work. A prominent English surgeon removed scores of colons for constipation and taught people in the different countries all over the world to do the same work. The majority of us who are members of the American Surgical Association could see no reason why these patients should be operated on for simple constipation in the absence of gross pathologic changes in the bowel which we regarded as giving proper cause for the removal of part of the colon. Adami, who died recently, and who was one of the great pathologists and later dean of the medical school at Liverpool, in discussing this operator's point of view, attributed it to over-enthusiasm, and was quite plain in his statement that he himself had had obsessions in his pathologic work, that he had been controlled by a certain line of reasoning for years at a time which he later found to be erroneous. I would group such work under the head of bad judgment. For instance, a number of medical men believe there is such a thing as chronic appendicitis. We believe in our clinic there is no such thing in the strict sense of the term. We recognize perfectly recurring attacks of appendicitis. We never recommend a patient to have his appendix removed unless he has had a definite attack of appendicitis. Those men who believe in chronic appendicitis will operate on hundreds and thousands of cases which we would turn over to the internist with the belief that the patient has some irri-

tation of the colon, some colitis that can be very properly handled medically. A great deal of work is done in gynecology which probably should not be done. There again you have the same problem, the question of judgment. On the other hand, there are some men—I think they are few—who operate for a fee. They have patients come to them who have some abdominal condition, which they diagnose as appendicitis and remove the appendix, controlled largely by the question of fee. I know that perfectly well because I have seen quite definite instances of that sort of thing. It is tremendously important for you in analyzing one of these cases to always ask yourself What would I do if this case were myself, my wife, or one of my children. That is a very simple rule, and it is one that works admirably. It is one that every medical man should keep constantly in mind in the handling of surgical cases of this kind.

CLINIC OF DR. KELLOGG SPEED

PRESBYTERIAN HOSPITAL

UNUNITING FRACTURE OF THE NECK OF THE FEMUR

Reconstruction Factors Following Union After Fracture.—Union obtained after fracture of a bone is not as yet proved to be purely a local mechanicochemical result. The physical requirement of reasonable apposition between bone fragments must be met clinically to give ordinary union in an average period of time. Bony union, no matter how it is obtained, whether as normal callus formation in the usual fracture, or by the insertion of a bone-peg transplant, the application of a metal plate, or the simple freshening of bone surfaces in fractures requiring operative treatment, has not physiologically ended the repair and led inevitably and completely to firm functional union with the usual thought-free guarantee that the bones of our skeleton constantly serve us. The local process of callus formation or calcium salt deposit is not the end stage of the process. A refining and rebuilding process of the newly formed bone must continue long after callus as such has been finished. The local physiologic demands favorable to this deposit of calcium salts must be advanced and then sustained until the impaired bone has ample opportunity to rebuild its fine supporting trabeculæ back into the condition of normal healthy function-sustaining bone. The principal factors after apposition of fragments aiding this return to mature bone which will bear the demands of every day use after any fracture are: (1) Immobilization, rest, (2) proper food, and (3) other physiologic elements. For these last named elements some irritation of use is required that the bone may be induced to react and to re-establish itself as mature bone—but this use must be guarded to insure a natural cementing and hardening process which prevents distortion or softening of the bone before it is fully able to take up its complete burden in ordinary activity.

Ununiting Fracture.—If these general requirements are not met after any fracture, a callus built up in the natural way by the effort at repair and one which has really gone on to a supposed clinical union between fragments, may in some instances become undone, the healing process is reversed, calcium salts disappear from the place they occupied and were needed, and a condition of separation approaching a non-union may supervene.

Fracture of the neck of the femur concerns an area of relatively small size of bone surface, one which involves functionally the use of the whole leg, and is concerned with nearly every movement of the individual, one in which it is rather difficult to promote healing on account of its blood-supply, and the frequent presence of an untoward age factor.

Definition of Ununiting Fracture.—Ununiting fracture of the neck of the femur may be defined as a healed or apparently healed fracture which in a varying period of time after the patient becomes ambulatory, develops pain and leads to an exaggeration of the lameness which was gradually being overcome in the patient's gait. Additional shortening over that found when the fracture was pronounced healed becomes manifest; a roentgenogram shows a beginning coxa vara or slow bending of the neck which reduces its angle with the shaft, and a possible separation through the old fracture plane may ensue. In some instances where the process extends and the patient fails to report or is not carefully and progressively studied by the physician, fragmentation of the head of the femur or absorption of the neck may follow.

Causes of Ununiting Fracture.—This condition of ununiting fracture of the neck of the femur is not confined to elderly people; it may occur at any age in patients suffering this injury. It is understood in every case, however, that a good approximation of fragments has been obtained. The search for causes brings out the following factors:

1. There has been insufficient callus: The individual's reaction after the fracture has been subnormal, *i. e.*, not enough calcium salts have been deposited to give the stiffening support required in this part of the bone. This callus deficiency may be an in-

dividual deviation from normal influenced by age, faulty bone forming powers, lowered vitality, or shock from the original or other injuries, circulatory disturbances, intercurrent infections, or improper diet and hygiene during the course of ordinary fracture repairing time.

2. An insufficient period of immobilization is the second cause: After adoption of the Whitman method or position for treating fracture of the neck of the femur may surgeons were inclined to feel that all the problems of fracture of the neck of the femur were solved. Possibly they were if the patient were given complete and sufficiently long immobilization. Too short a period of immobilization does not permit enough calcium salts to be deposited in this slowly filling area of the neck of the femur to cement the bone fragments. The use of motion too early in this process breaks down the delicate network of out-growing capillaries which are carrying the salts to the fibrous tissue framework. When the capillaries are discouraged or broken down pure fibrous tissue results, which contracts, cuts off circulation, and leads to a cicatrix without its modicum of calcifying salts or callus. The period of immobilization must be long enough to permit the natural process for the laying down of calcium salts to go on to a normal end. *It must not be interfered with by any motion at the fracture site.*

3. Too early weight bearing is the next great factor: Too early weight bearing may follow insufficient immobilization because the surgeon who does not study the situation thoroughly enough to time his immobilization to meet the requirements of his patient is most liable to be the one who orders or encourages too early weight bearing. When this too early weight bearing comes on normal callus it has sufficiently untoward effects. When it comes on immature or insufficient callus after an improper period of immobilization it has double untoward effect and a disintegrating or an ununiting process is set up.

When callus has formed and starts to ossify into hard bone, its solidarity—its final building into normal sustaining trabeculæ of bone suitable to the purposes of the site of the break—is encouraged and guided by functional requirments. One might say

that this is simply a restatement of Wolff's law of bone. A fracture of the neck of the femur with sufficient cementing callus clinically present must be guarded against too early weight bearing else the callus will be reabsorbed. If this requirement is not met, dynamic factors of pressure and cross strain induce bending and fragment separation which inevitably lead to this phenomenon of ununiting fracture.

Clinically we all believe that early weight bearing must follow as soon as possible after fracture; but first we must provide both active exercise of the limb and restoration of proper circulation in it before requiring that the burden of the body shall be carried on it. The return of the limb to physiologic condition is the first step to be obtained. Weight bearing then follows. At first it must be guarded, and not 100 per cent., any more than the race horse would be asked to go out on the track and win without proper training. Some method of partial or supported weight bearing must enter into the train of treatment with the help of crutches or other supports.

These remarks apply equally to those patients who have suffered fracture of the neck of the femur, and obtained a reduction made by traction, inversion, and abduction of the limb with a roentgenologic control which assures the surgeon of a satisfactory apposition of fragments. When the shortening has not been fully overcome, when the apposition of fractured bone surface has not been complete or even highly satisfactory, or when the neck angle has not been reconverted into its normal of 130 degrees, the points mentioned are doubly important.

We find that other factors must also be included in a full understanding of healing after fracture of the neck of the femur. The surgeon must consider the gross weight of the patient, particularly when it is above average. The condition of the vascular system, sclerosis of the palpable vessels, myocardial vigor or a general tendency toward asthenia or poor nourishment likewise offer untoward influence. In children one must likewise consider possible endocrine disturbance such as seen in fat indolent boys with poor genital development, or subthyroid activity. In this class of patient the so-called slipping epiphysis

of the proximal end of the femur resulting from trauma, falls into the clinical class of fracture of the neck of the femur. Such patients seem prone to a prolonged course of bone healing which if unrecognized and put to strain too early, leads to secondary displacements at the neck of the femur.

Treatment of Ununiting Fracture of Neck of Femur.—The treatment of the condition labeled as ununiting fracture of the neck of the femur may be divided as follows:

(*a*) Prophylaxis:

1. During course of active treatment of fracture of the neck of femur.
2. After clinical union seems obtained.

(*b*) Active treatment:

1. When the condition is first recognized as incipient ununiting fracture.
2. When the patient comes with the ununiting condition well established.
3. When gross separation of fragments and true nonunion have unfortunately followed.

(*a*) *Prophylaxis.*—1. The active treatment of fracture of the neck of the femur except in those rare instances of solid impaction which insures rapid and sure healing, has practically been reduced to the use of traction downward on the limb to pull the trochanteric portion of the neck down to the level of the fractured surface of the head fragment, inversion of the foot to rotate these surfaces into intimate and meshing contact, followed by abduction of the leg as a whole to insure the maintenance of this contact. The trochanteric surface is thereby held suspended by the ileofemoral or Y-ligment snugly up against the surface of the head fragment. The position is one of impotence, to use Whitman's expression. The patient thus held cannot voluntarily move the fragments and cause them to separate. This position is most easily sustained by a plaster-of-Paris spica covering the whole of the injured limb, holding it firmly locked against the pelvis and trunk which are covered by the plaster well up to the costal margin or even the nipples. It requires considerable experience in plaster work to enable the surgeon to apply

this spica encasement, keep the patient comfortable, and to keep the plaster intact for the long period of immobilization required.

In practice in the fracture wards of hospitals the hip spica alone is not relied upon; the plaster is made to include the sound thigh to the knee, and a brace is inserted between the thighs to obviate any change in the abduction. This type of body encasement can be built without acute inconvenience to the patient, except that he *must* lie in it and be thus immobilized. The plaster need not become a prison, however, for with this type of dressing carefully cut away from genitals and buttocks, the patient may be turned from one side to another; may be tied up to a supporting pole over the bed, or slung in a hammock, or much to his advantage may be turned over completely on to his face for an hour or more daily. These changes provide an interesting daily routine and furnish exercise. They lead to better care of the skin of the buttocks and back, and the avoidance of pressure sores.

Immobilization in this plaster splint should last from sixteen to twenty weeks for fracture of the neck of the femur.

2. When the plaster is removed, roentgenologic control of the amount of callus and union is imperative. If this is satisfactory, the patient is kept in bed for one additional week. Knee-joint motions are started, aided by hot applications and gentle massage of the knee and thigh. The patient begins to move the limb to help himself and to turn over in bed. If he has any ambition after a week or ten days he begins to ask when he may get up. This time has now arrived, and he is picked up and put in a chair. After a few days, heart action responding, he is then ready to stand.

At this point comes the great dividing line in prophylactic care. *His standing and early weight bearing must be guarded.* Crutches and other support are not quite sufficient. The patient will unconsciously bear weight on the freshly healed hip as soon as he can stand and he must be warned against it. Either a lift of sufficient height must be attached to the shoe of his well foot so that he cannot touch the foot of the injured leg to the

ground, or he must be fitted with a walking caliper which softens the brunt of early attempts at weight bearing by transmitting much of the force from the ground to the ischium by means of the metal side bars of the caliper.

The patient then rapidly progresses with the help of the caliper and crutches. He does not overstrain his newly acquired union. In a few weeks, four to six, he will become irked with the caliper. He wants to leave it off; he wants to move his knee more, or he dislikes the weight, appearance, and inconvenience of the caliper. He must not be freed from the caliper support, however, until the roentgenologic control shows that denser union is progressing and until the surgeon is assured that the neck of the femur will sustain unassisted, its renewed job of weight bearing. The very best criterion for this control is evidence in the roentgenogram that the trabeculæ of bone in the femoral neck have re-formed in their axis of normal weight bearing.

When this re-formation of bone trabeculæ is satisfactory, the caliper is removed for unaided weight bearing. During this indeterminate number of weeks, because no set time can be put down for the individual case, the patient may remove the caliper when sitting or lying. He must use it for all weight bearing, or else keep the foot off the floor.

(*b*) *Active Treatment of Ununiting Fracture of the Neck of the Femur.*—1. INCIPIENT UNUNITING FRACTURE: When the condition of beginning ununiting is discovered by examination which includes the roentgenogram, treatment is relatively simple. The patient must at once be saved from himself; that is, his hip must be reimmobilized as in an instance of fresh fracture. Half measures will not suffice. Going to bed, lying on a couch, promises not to bear weight are inadequate safeguards. The process of non-union is so insidious that it requires prolonged firm measures. The patient must be re-established in the quiet and complete rest of the body plaster-of-Paris encasement. His course may be as long as after the original fracture. The controls after removal of a second plaster splint are identical with those used in the recently healed union.

2. ESTABLISHED UNUNITING FRACTURE: When the patient comes with the condition of ununiting fracture established; when at any time fragments may completely separate following a slight misstep, when pain becomes an important disturbance, and coxa vara threatens or is present, the plaster-of-Paris encasement may be resorted to, the long immobilization followed out and union may eventually be satisfactory. A slight coxa vara present may be overcome by going through the procedure of a reduction of fresh fracture.

If the patient is unwilling to take a chance at getting a union without the use of operative measures, and insists on a procedure which may promise more for him he falls finally into the third group.

3. INDICATIONS FOR OPERATION AFTER UNUNITING FRACTURE: When gross separation of fragments and true non-union have followed in the wake of this process of ununiting fracture, operative interference is indicated. The only exception lies in the adolescent with his transcending power of recuperation and his amenability to quick reaction from helpful medication directed toward physiologic deficiencies if any are present. On adolescents with ununiting fracture of the neck of the femur, even if the head becomes fragmentary one does not operate. These patients retain a surprisingly good range of motion and any growth interference is relatively negligible after such a separation of the neck.

The type of operation required to secure an attempt at bony union is largely a matter of choice. I believe the attempt in the average case, with some bony bridges at the neck still persisting, consists in simple freshening of the fractured surfaces through an anterior approach over the hip-joint. A short incision in the long axis of the leg, directly over the neck of the femur external to the femoral vessels affords a rapid and relatively bloodless route to the site of fracture. The neck of the femur is exposed, retraction gives a fair view of the fracture, so that a chisel can be employed to cut away fibrous tissue back to bony surface. The limb is then pulled by traction in its long axis, inverted, and fully abducted insuring contact between

freshened surfaces. This is followed by a plaster-of-Paris encasement in the position of extreme abduction for eighteen to twenty weeks.

The use of bone-pegs or other foreign material such as ivory or metal nails or screws, inserted through the trochanteric portion of the femur into the head, or any special device simply aids in apposition of fractured surfaces. *Freshening of these surfaces is absolutely necessary* as a prerequisite to treatment in this type of pathology and the postoperative position and immobilization must be insisted upon as in the operation of simple bone surface freshening when no pegging foreign material is inserted. It need hardly be said that the technical and mechanical difficulties of the pegging operation in the neck of the femur are great; few men do them brilliantly.

If the head of the femur is disintegrated; if the neck is absorbed, one must rely on the various reconstruction operations to cure the pain or fall back on that sure procedure—ankylosis of the hip-joint in favorable functional position of about 30 degrees abduction with the pelvis and leg extended in a straight line.

Examples of Ununiting Fractures of the Neck of the Femur.—Mrs. S., fifty-six years old. In July, 1927 about sixteen months before she was first examined the patient remembered a fall off a step following which she had some pain in her right ankle for two weeks, limped, and then walked in the next six months without any difficulty whatsoever. Four months later she fell two steps and turned the same ankle, limped about for three or four weeks, but was not confined to bed and then was able to walk normally. She recalled no other trauma of any kind.

From December, 1927 to February, 1928 she developed an illness diagnosed as influenza which was accompanied by cough and a fever. Mental changes then followed with fever varying between 102° and 104° F. No trauma of her legs was sustained during this period to her knowledge.

From February to May, 1928 she was confined to bed and was seen by Dr. Gill who diagnosed sleeping sickness. She was

under the care of two trained nurses in her own home during this period and after her recovery had a persisting spastic torticollis.

In May, 1928 she was allowed to be up and had no discomfort or difficulty in walking for the first week, after which she complained of pain and stiffness in the right hip region. Difficulty in walking increased. She had to use crutches, but by July, 1928 much of her pain had subsided leaving considerable lameness, requiring support in walking, and a greatly lessened sphere of activity. Pain in the right knee became a prominent symptom along with a feeling of twisting in that joint when she bore weight on her right leg. She was seen and examined on July 19, 1928.

The general physical examination excluding the spastic torticollis was reasonably normal for a woman of her age. The right hip region was tender to pressure applied over the anterior surface of the joint, or laterally at the greater trochanter of the femur. The pelvic bones appeared normal with a little tenderness to pressure in the sacral region. The left hip was normal. The right leg was held in slight adduction. She was able to walk with a cane or crutch support, but with each step painful. On measurement the right leg was found to be $\frac{3}{4}$ to 1 inch shorter than the left. She was able actively to adduct the right leg and foot a little, but could not raise the heel from the table surface. All active and attempted passive motions in the right hip were quite painful and considerably restricted.

The roentgenogram showed an old fracture of the neck of the femur ununiting. There appeared to be about 1 inch shortening. The edges of the fragments showed considerable effort at new-bone formation, but also some absorption and rounding off. My impression was that the fracture had occurred at least several months before I saw her and had begun to unite while she was in bed during her long illness. It had then started to ununite when she became ambulatory.

On August 3, 1928 at the Presbyterian Hospital after she was placed on the Hawley table an incision 5 inches long was made over the anterior aspect of the right hip-joint. The frac-

ture at the neck of the femur was rapidly exposed after cutting open the hip-joint capsule permitting the escape of a small amount of reddish glairy joint fluid. The surfaces of the fragments were freshened with a chisel and gentle curetting to remove all fibrous tissue found between, the limb placed in the Whitman position and a body plaster-of-Paris encasement was applied from the ribs completely covering the right leg and the left leg down to the knee. A postoperative roentgenogram showed a satisfactory apposition of bone surfaces, and a reestablishment of the angle of the neck of the femur. She left the hospital on September 8, 1928 still encased in the plaster and has just been removed after seventeen weeks' immobilization. *x*-Ray and physical examination show a union has probably been obtained. She will, of course, be subjected to a careful follow-up survey during her convalescence, and has been fitted with a walking caliper.

Miss S., aged forty years, was seen and examined by me on February 19, 1927. Her story was that late in December, 1925 she fell down four steps inside a church door and broke her left hip. She was taken to a nearby hospital and put in plaster-of-Paris body encasement with the legs abducted. In this plaster she remained forty-four days; then the splint was removed, and she was allowed and encouraged to walk on crutches with a lift on the shoe of her good foot. For three weeks she walked thus—able to lift the recently injured left hip—but she bore no weight on it. For three additional weeks she barely touched her foot to the floor in walking on crutches, and then removed the lift on her shoe, and took to walking with a cane for support with full weight on both legs. Up to this time, over twelve weeks after her accident, she had practically no pain in the left hip.

She returned to her work in April, 1926 a little over four months after her fracture, using a cane and walking considerably. In October, 1926 she was instructed to start walking without any cane. She then had some pain in both the right leg and hip.

Her roentgenologic control consisted of one film at the time of accident—December, 1925—another forty-four days later

when she was removed from plaster and none following until January, 1927. She was then told to cease weight bearing as the condition of ununiting fracture threatened. Non-union was probably appreciated by her physician.

At my examination her chief complaint was worry about something being wrong with her hip. She thought her left leg was a little shorter than the right, but she walked quite well except for a a slight limp, with her left foot held straight forward and her heel raised. Upon test 1 inch difference in length of her legs was found and it was determined that she was able to lift her left leg and foot from the table. She could also actively invert this foot fairly well. The greater trochanter of the left femur appeared to be in normal relationship to Nélaton's line.

An *x*-ray film at this time (February, 1927) showed apparent impaction of the neck of the femur with very little real bony union between the fragments.

She was placed in a walking caliper which she wore faithfully when weight bearing.

On May 9, 1927 there was scarcely any pain in her hip. Another roentgenologic examination showed the bone pathology in an unchanged condition since February, 1927.

It was then decided to attempt two weeks walking without caliper support as a clinical test. She reported on June 6, 1927 saying that there was a slight pain in her left thigh at times. She was to continue walking around her home without support.

On July 29, 1927 she reported that after sitting a while and then trying to get up severe pain started on the inner side of the left thigh. After walking a few steps this pain rapidly disappeared, and was not followed by dull ache. Her gait was a little improved, but she was disinclined to walk, probably not so much on account of pain as because she did not walk normally or well.

Roentgenogram at this last date showed no evidence of further bony consolidation. There existed rather an increased absorption of the head of the femur. A reconstruction operation on the hip was then advised, but refused. At this stage of her ununiting fracture so long after the original accident with pain and disability prominent symptoms, a reconstruction operation

was indicated. Until that is done all her symptoms will remain as long as she is ambulatory. She may develop complete separation at the fracture site with increased shortening and with still less control over the leg. Such a condition may go on for several years and reach a final stage in which there is a maximum amount of

Fig. 98.—Miss S. At the time of the first examination the patient was walking on the leg with considerable pain in the hip-joint. Whether the amount of separation shown between the neck and head fragments is recent or not there was no way of telling because previous *x*-ray films were wanting. There seems to be some callus and very slight bone existing between the two major fragments, but, on the whole, the fracture is beginning to separate and can be classed as an ununiting fracture.

shortening and limp, with a minimum amount of pain which permits considerable function in the limb.

William G., twelve years old. Seen first and examined July 15, 1925. In January, 1925 while skating he fell and bumped his right hip and later in March of that year he suffered some

slight trauma on the same hip when he fell off a bob-sled. Neither of these accidents caused much if any lasting pain, and after limping around for a day or so he walked normally. He is a large heavy boy with no real evidence of thyroid or genital deficiency, bright, and very active.

On July 4, 1925 while visiting an uncle they had a friendly wrestling match in which his right leg was violently twisted by the stronger and heavier relative. The patient fell to the floor and could not get up or walk. He was taken to a hospital a few miles away. A fracture of the neck of the femur was found and an ambulatory splint was applied, apparently no real effort being made to affect a reduction of the displaced neck of the femur.

On July 15, 1925 my examination showed after removing the ambulatory splint, that there was 1½ inch shortening in the right leg. The greater trochanter was above Nélaton's line and the foot lay everted. He was not able to raise his right heel from the table. A roentgenogram (Fig. 99) showed a separation through the proximal epiphysis of the femur and the usual separation with the trochanteric portion of the bone adducted and drawn upward.

Under a general anesthesia the fracture was reduced satisfactorily (Fig. 99) and he was placed in body plaster. After four days in the hospital he was taken home and spent fourteen weeks in the plaster dressing.

When he was removed from the plaster he was fitted with a walking caliper. A control roentgenogram was made showing the fragments in the same position as at the time of reduction, considerable effort at callus being evident.

He wore the caliper over four months spending the winter in the south exercising freely. A control roentgenogram in the spring of 1926 showed an apparent firm union and the use of the caliper was discontinued. There was no shortening in the right leg.

In the autumn of 1926 he was sent to a military school. On October 24, 1926 he was brought back to me with the information that the strenuous drilling and exercises incidental to his school activities had caused a return of his limp and some pain.

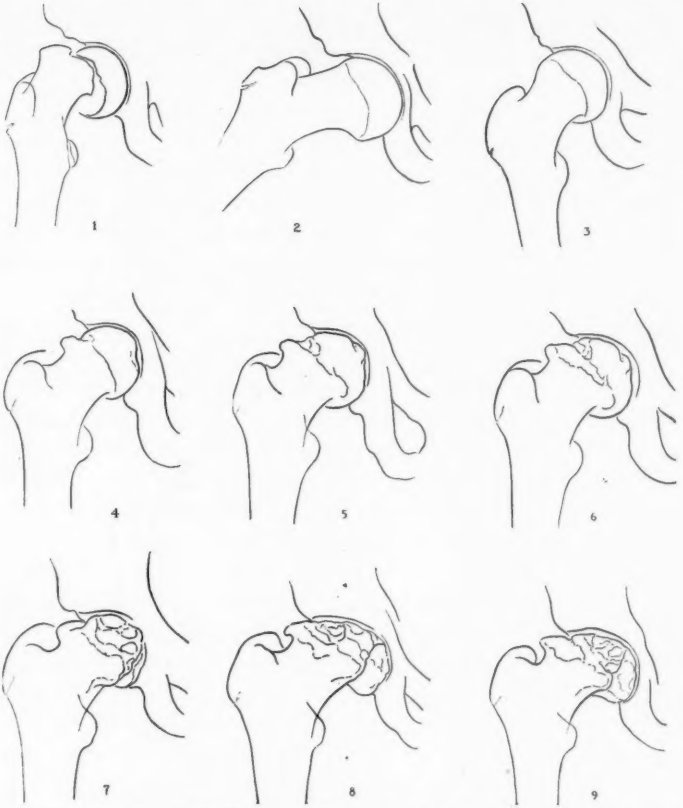

Fig. 99.—Case of William G. The original fracture, a traumatic separation of the upper epiphysis of the femur occurring July 4, 1925 is shown in 1; 2 is the reduction; 3 is the condition at the time he was removed from plaster, fourteen weeks later; 4 shows the slight coxa vara and beginning changes in the neck immediately after his return from military school in October, 1926, prior to which time he had had no shortening or pain; 5–9 show the progressive change following in the next eighteen months in spite of the support afforded by the caliper and the saving of the joint from rough weight bearing and overuse. The head has become fragmented, partly absorbed and flattened, until it looked like a regular case of Legg's disease. The condition now seems to have reached a final stage; abduction of the hip is but a few degrees—he can flex it to 90 degrees; no more pain, no increase in shortening. He has grown to a height of 6 feet, ¼ inch and weighs 190 pounds, although but little over fifteen years of age.

His instructors had forced him into greater efforts in spite of this condition until it was discovered by his father on a chance visit to the school.

The examination in October, 1926 showed some restriction of motion in the right hip-joint with pain, $\frac{3}{4}$ inch shortening of the leg, and a lessened endurance in that limb for play or work. He had gained considerable height, and was somewhat thinner in proportion. The roentgenogram showed some bending of the neck of the femur, some coxa vara with considerable excess callus along the upper margin of the neck, but no definite evidence of any refracture.

It was necessary to remove him from the military school, refit him with his caliper, and put him into high school with restriction of exercises and games. He walked in the caliper to school and climbed stairs, etc., as usual.

A series of examinations and roentgenograms followed. All during the year 1927 the right leg maintained $\frac{3}{4}$ inch shortening. The coxa vara did not increase, and he went about in ordinary activity.

On November 13, 1927 there was still found $\frac{3}{4}$ inch shortening in the right leg. The right hip had practically no active abduction, 40 degree flexion. The roentgenogram showed almost complete fragmentation and flattening with disappearance of outline of the head of the right femur, including some additional new bone formation about the old epiphyseal plane. He had then not worn the caliper for five months, as his pain had ceased and the leg shortening had been stationary.

A re-examination on May 28, 1928, nearly three years after his original fracture of the neck of the femur, showed that there still existed $\frac{3}{4}$-inch shortening in the right leg. The roentgenograms showed no increased coxa vara, the fragmentation of the head which seemed partly absorbed had advanced, yet the head of the femur seemed of a uniform density. There was an increase of bony spur formation around the neck of the femur. His abduction of this joint was nil. He was able to flex the thigh to a right angle with the trunk. Adduction was possible for but a few degrees, and extension beyond a straight line was very

little. He ran, played, and had no pain whatsoever at that time. His weight was 190 pounds and his height 6 feet, $\frac{1}{4}$ inch, although he was but little over fifteen years old.

A résumé of this boy's injury shows these facts: At twelve years of age he fractured the neck of his femur through the epiphysis. The fracture was well reduced, held in inversion and abduction for fourteen weeks in plaster of Paris, and his convalescent walking and weight bearing were constantly guarded by a walking caliper. Over a year after the fracture, following very strenuous exercise and drilling, the neck of the femur began to bend, the head began to become fragmentary and absorb, and three years after injury he had $\frac{3}{4}$-inch shortening of the leg, greatly reduced hip-joint motions, a nearly completely absorbed head of the femur. At no time in the course of his trouble did he have any fever or evidence of infection. His health remained good; he gained much weight and height.

In attempting a critical review of the treatment of this boy one can say that his fracture was well reduced, controlled by roentgenogram, treated in an orthodox manner by prolonged immobilization, and guarded weight bearing. The important untoward factor seemed to be the excessive exercise he was called upon to perform over a year after the fracture was apparently well healed.

Whether the epiphysis had been partially displaced in the months before the final separation took place, on July 4, 1925, no one knows as no roentgenograms was taken prior to that time. He was able to walk without pain or limp except for the few days mentioned in the winter before the accident. He had suffered no infectious disease or process in the recent years preceding.

The possibility of endocrine disturbance was not fully determined. No basal metabolic rate was taken. The boy, while heavy, was very active in all ways. His subsequent growth to a height of over 6 feet at sixteen years of age seems to speak against hypothyroidism.

The adequacy of the treatment from the standpoint of the progressing fragmentation of the head of the femur will always

be debatable in my mind. If I had taken him again in October, 1927, placed him in a body plaster-of-Paris encasement to relieve all pressure on the head of the femur, would the absorption of this part of the bone have been stopped? Ought there not have resulted greater stiffness and limitation of hip-joint motion? The guarded weight bearing with constant watch for additional shortening seemed the sensible way out considering the importance of the boy's education and general activity. The result is very satisfactory to his parents.

Mrs. J. S., fifty-seven years old, stepped off a chair in her country home on July 7, 1927. A local physician diagnosed fracture of the neck of the left femur and placed her in a padded wooden splint—probably a Liston's splint. A consultant surgeon was sent for. He advised the application of a plaster-of-Paris dressing in which she was placed, legs in abduction, remaining thus until September 6, 1927 when she was brought in the plaster to a Chicago hospital.

The plaster body encasement was then removed and an *x*-ray made of the left hip. This was said to show satisfactory position and *callus*. The patient remained in the hospital three days and then was taken home, her left leg lying quietly—the left knee stiffly. After five weeks at home she started to walk using crutches and bearing weight on her left hip. On May 1, 1928 she stopped the use of crutches and began using a cane for support. From that time until July 2, 1928, when I first saw her, she had been under the care of an osteopath getting light massage to her hip and leg. There was no roentgenologic control between September, 1927 and July, 1928 when I saw her.

Her complaint was of pain in the left hip, especially at night. Lately she had had to cut down the amount of walking she did on account of increased pain and she had had to resume one crutch and a cane, or the support of the banister on going down stairs. Her left leg seemed a little short to her and just the week before she had returned to the use of two heavy canes for support in walking because they seemed to relieve the pressure pain on her hip.

The examination showed essentially that the left hip was a

little fuller or wider than the right on inspection. She was unable to raise the left heel from the table when lying supine. There was less than ½-inch shortening in the left leg and the greater trochanter of the left femur could not be made out above Néla-

Fig. 100.—Mrs. J. S. Print of a skiagram taken at the time she first consulted me. Evidently a very happy reduction of this fracture had been made, as the length and axis of the neck and apposition seemed to have been very good. The fact that she bore weight too soon has led to disintegration of the callus which had formed, leaving small bridges of bone with some locking of dentate surfaces which alone seemed to hold the fragments together. She was walking and used only a cane. It appeared at that time that complete separation might not be far off, but that has not occurred after seven months, although her pain has continued and she refuses operative treatment.

ton's line. She was able to flex her hip to a right angle with the pelvis—then pain developed, and stopped the range of motion. She had little if any power of abduction or external rotation of the limb as a whole.

The roentgenologic examination (Fig. 100) showed considerable absorption in the neck at the plane of fracture. The major fragments appeared still to be in contact and had small connecting bands of yet unabsorbed callus or bone. There was not yet developed any coxa vara, but the impression was given that unlocking of fragments, sudden shortening, and external rotation of the foot might occur at any time from a misstep or trivial twist of the leg.

The situation was explained to the patient and she was advised that replacement in plaster for a sufficiently long time followed by guarded use with a caliper if bony union developed offered her the easiest way out of her difficulty. This was refused and the patient still persists in her invalidism.

A review of the treatment of this fracture shows that it was well reduced, was immobilized in plaster for eight and one-half weeks—perhaps less than half long enough to obtain bony union. Thirteen and one-half weeks after fracture she began bearing weight with crutches—far too soon as she would not, ordinarily, have yet obtained bony union at her age if she had been immobilized in plaster *all that time*.

She then used crutches for seven and one-half months—quite too long a time if she had ever obtained a bony union, and to cap the climax of her ununiting fracture, submitted her limb to the useless and callus-destroying ministrations of an ignorant osteopath—all without roentgenologic control.

CLINIC OF DR. DANIEL N. EISENDRATH

MICHAEL REESE HOSPITAL

CYSTITIS

YOU may consider it rather unusual to select an apparently familiar disease as the subject of today's clinic. I find, however, few understand that the symptoms of both acute and chronic cystitis are in the majority of cases simply the local expressions of etiologic factors outside of the bladder. If one starts out with the hypothesis that most cases of cystitis are secondary to some extravesical lesion, the treatment will be far more satisfactory as to end-results, than it is at present.

The first patient whom we will present today is a man of forty who gives the history of frequency of urination, especially marked during the day time. He has had several attacks of acute gonorrheal urethritis, the last one about five years ago. Now frequency is a very common manifestation of inflammatory changes involving the vesical trigone. A normal individual urinates once or perhaps not at all during the night, and four to five times during the day. When, however, he or she is obliged to get up three, four, or five times at night, and experiences the desire to void urine every hour or so during the day, one is justified in speaking of this condition as frequency. The majority of persons are scarcely conscious of the existence of a bladder under normal conditions. Their attention is quickly directed towards this viscus, however, when they are obliged to void urine at frequent intervals. This is especially the case when the frequency is preceded, accompanied, or followed by pain referred to the vesical neck or to the urethra. Not uncommonly the pain is almost continuous. Scarcely has the bladder been apparently emptied when the pain and desire to urinate recur immediately, and the entire cycle—*i. e.*, pain, desire to urinate, and burning—are again

felt until existence becomes almost intolerable. To this exaggerated degree of frequency and pain the term formerly applied was strangury, but we now prefer that of tenesmus.

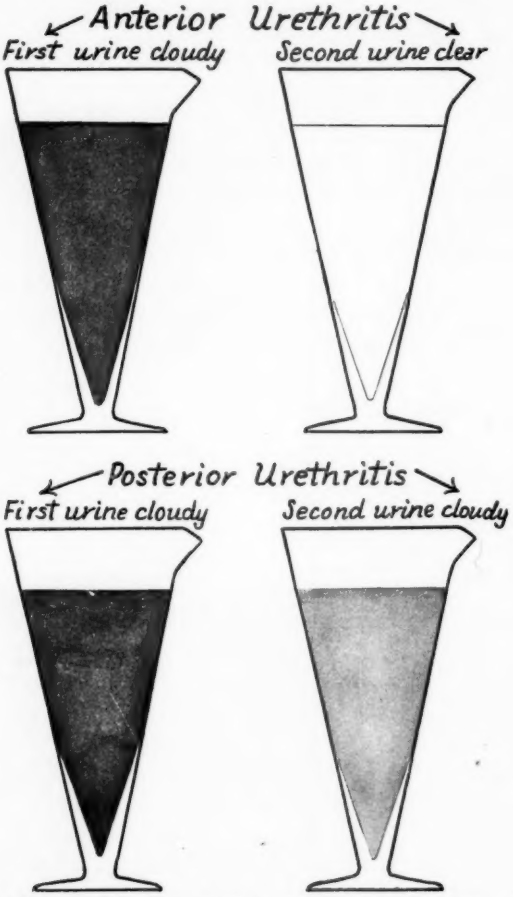

Fig. 101.—Glass tests in anterior and posterior urethritis. (Eisendrath and Rolnick, Urology, J. B. Lippincott Co., Publishers.)

This first patient gives a history of tenesmus during one of his attacks of urethrocystitis, but his chief complaint today is

only frequency. The urine which he has passed in two glasses shows turbidity of equal amount in both (Fig. 101). This indicates that the inflammatory process not only involves the deep urethra, but also the bladder. Smears made from the centrifuged sediment reveal the presence of Gram-negative extracellular diplococci and some Gram-negative bacilli resembling, morphologically, the colon bacillus. You will note that these findings indicate the existence of some postgonorrheal infection in which the true or intracellular Gram-negative biscuit-shaped diplococci of Neisser have been superseded by other pyogenic bacteria.

Rectal palpation reveals the presence of a fairly large, soft prostate. Now you must never be satisfied that a complete rectal

Fig. 102.—Diagram employed by Dr. Hugh H. Young to record findings on rectal examination of prostate and seminal vesicles. (Eisendrath and Rolnick, Urology, J. B. Lippincott Co., Publishers.)

examination has been made unless an attempt be made to palpate the seminal vesicles. Under normal conditions these are not to be felt. In this patient, however, by inserting the finger a little deeper into the rectum, well above and lateral to the prostate, you can readily palpate a sausage-like elongated enlargement radiating laterally from the prostate (Fig. 102). These are the greatly distended seminal vesicles. Now let us attempt to express the contents of these structures and of the prostate by massage and ask the patient to pass some more urine. You will agree with me that the diagnostic data have been greatly amplified by our findings. This third urine passed after such massage contains a much larger amount of pus than

either the first or second. You can also note some large whitish membranous and some comma-like shreds floating in this third urine. The former are casts of some of the many diverticula (Fig. 103) of the seminal vesicles while the comma-like shreds are of prostatic origin.

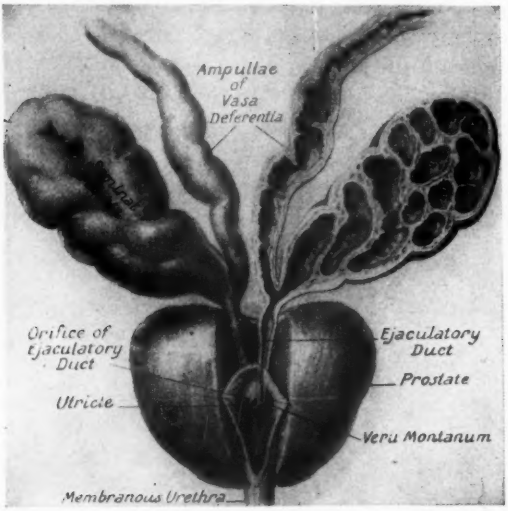

Fig. 103.—Mode of ending of the ampulla of the vas deferens in the neck of the seminal vesicle. Note how the ejaculatory duct is a direct continuation of the seminal vesicles. (After Toldt.)

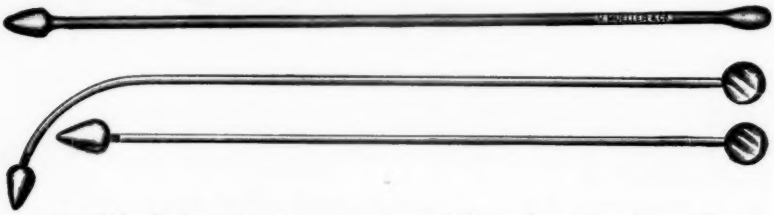

Fig. 104.—Bulbous bougies: top, woven silk; middle, curved metallic; bottom, straight metallic. The woven silk is most commonly employed.

We will next examine his urethra with bulbous bougies (Fig. 104) in order to ascertain the presence or absence of a stricture. A No. 25 bulb encounters no resistance as far as the vesical neck.

We will now examine the entire urethra and floor of the bladder with a cysto-urethroscope under more or less continuous water irrigation. Under normal conditions the lumen of the urethra is merely a slit because of the apposition of the folds of its epithelial lining. One can only inspect the appearance of the urethral mucosa when some instrument like a urethroscope is introduced, so that the folds are "ironed out" so to speak. We prefer an instrument, especially for the posterior urethra, in which distention by water aids in such a flattening of the folds. For the anterior urethra some type of instrument which does not require the assistance of water irrigation is preferable.

Urethrocystoscopy in this patient yields but little information. The mucosa of the membranous and prostatic urethra as well as that of the entire vesical trigone is moderately red and edematous, but this would scarcely account for all of the pus found in the three urine glasses. The ureteric orifices and the remainder of the bladder mucosa do not present any abnormal changes. We can see no justification for urethral catheterization until the pathology in the lower urogenital tract has received our therapeutic attention. Now what must we conclude to be the underlying cause of this man's frequency and pyuria, which at first glance one would be inclined to ascribe to a cystitis? We have definite evidence of the existence of a (Fig. 105) postgonorrheal prostatitis and seminal vesiculitis as the cause of his bladder symptoms, in my opinion. The changes in his posterior urethra and bladder trigone are secondary.

This patient has received elsewhere, prostatic massage, urethral dilatation with sounds, and instillations into the posterior urethra of various germicidal agents with but little benefit. We must now aim to eliminate as far as possible, the infection in the seminal vesicles. This is a difficult problem. In many cases milking the contents of the vesicles into the ejaculatory ducts (Fig. 106) by making sweeping movements with the finger or some special instrument, well above and lateral to the prostate will be of great benefit. We usually supplement such massage by giving rectal suppositories every night containing $1\frac{1}{2}$ grains of ichthyol. As local urethral treatment following the

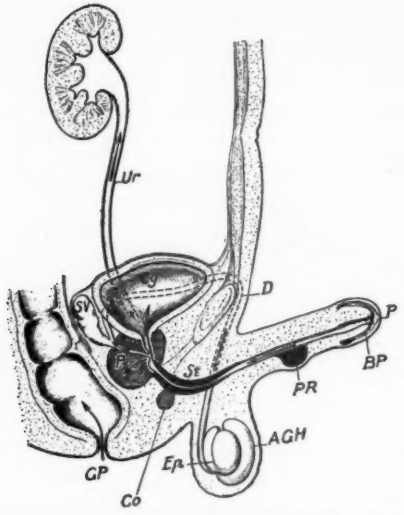

Fig. 105.—Diagram of most frequent complications of gonorrhea: *P*, Inflammatory phimosis; *BP*, balanitis; *PR*, periurethral abscess; *D*, vas deferentitis; *AGH*, acute hydrocele; *EP*, epididymitis; *Co*, cowperitis; *P*, prostatitis; *Cy*, cystitis; *SV*, seminal vesiculitis; *Ur*, ureteritis and pyelitis; *GP*, gonorrheal proctitis. (Eisendrath and Rolnick, Urology, J. B. Lippincott Co., Publishers.)

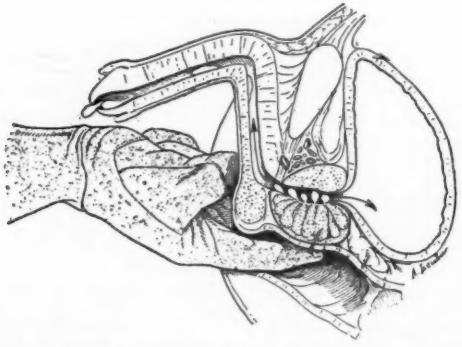

Fig. 106.—Diagrammatic representation of how massage of prostate acts (Papin).

massage of the prostate and vesicles we inject 10 c.c. of a 5 per cent. solution of silver nucleinate or some similar colloidal silver preparation into the deep urethra through a Guyon instillator (Fig. 107) with a glass syringe.

In many cases the prostatovesiculitis can at least be ameliorated. The frequency and pyuria may be greatly improved, and may disappear for a long period. It is only after a study of the

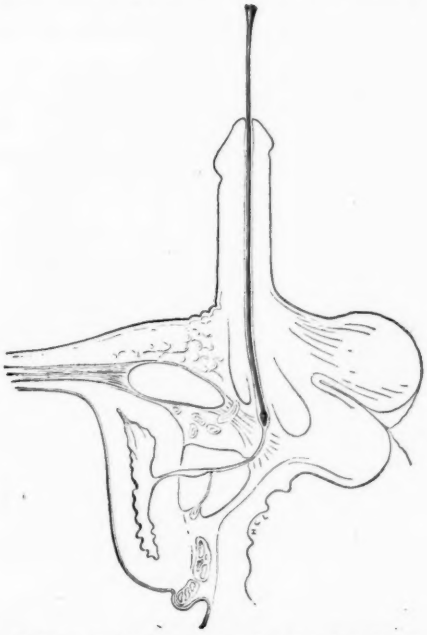

Fig. 107.—Sagittal section of male urethra showing the Guyon instillator-tip lying in bulbous portion of the urethra. (Eisendrath and Rolnick, Urology, J. B. Lippincott Co., Publishers.)

anatomy of the prostate and vesicles (Fig. 103) that one can realize why absolute elimination of these foci of infection is so difficult if not impossible. The gonococci are no longer responsible, but have been supplanted by other secondary organisms like the staphylococci, colon bacilli, etc., which are very resistant, especially when lodged in such structures as the acini

of the prostatic glands (Fig. 108) or the innumerable pockets of the seminal vesicles (Fig. 103).

In connection with another method of treatment of these cases, let me present a second patient, a man of thirty, who complained of symptoms thought to be as typical of a cystitis as in our first patient of today's clinic.

After a series of treatments elsewhere, consisting of massage of the prostate and vesicles, we suggested vasotomy. This consists in isolating the vas deferens on each side in the upper part

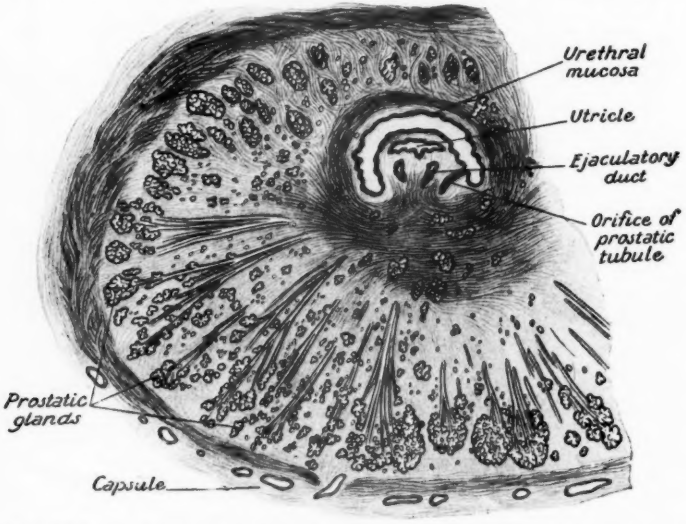

Fig. 108.—Cross-section of normal adult prostate to show how ducts of prostatic acini radiate from urethra. (After Toldt.)

of the scrotum. Care must be taken to separate the vas well from its sheath. The vas, having been exposed, is incised with a fine scalpel such as is employed for eye work, and a blunt-pointed narrow gauge needle induced into the lumen of the vas, so that fluid will reach the vesicles, *i. e.*, the needle must point toward the external inguinal ring. A few cubic centimeters of sterile salt solution are injected in order to determine the patency of the lumen of the vas. We now inject 5 c.c. of a 5 per cent. solution

of collargol into each vas deferens and close the vasotomy incision with very fine (000) catgut. This operation can be easily performed under local anesthesia.

Although such a method of treatment is not always successful, it is worthy of trial in cases of prostatovesiculitis which have not been benefited by simpler methods of treatment. This second patient, who had been greatly depressed over his condition, was pleased with the results of the vasotomy. His frequency has completely disappeared, as has also the burning and pain on urination. Even after vigorous massage of the prostate and vesicles the urine remains clear. Although I have had no personal experience in the treatment of seminal vesiculitis with neosalvarsan and sulpharsphenamin, Drs. Belfield and Rolnick have been greatly pleased with these remedies. Neosalvarsan is given in doses of 0.2 to 0.3 gram intravenously at intervals of four to five days for a series of 5 to 6 doses. Sulpharsphenamin is given in doses of 0.4 gram intramuscularly at the same intervals, and for the same number of injections.

Now let me present two female patients whose clinical histories are similar, both having as the outstanding feature symptoms usually interpreted as of vesical origin. In both cases urologic study revealed the fact that the cystitis was secondary to ureteral and renal conditions.

The first of these two patients is forty years old and has presented the same symptoms for the past two years. She has received every form of recognized treatment before being admitted to our service, without any benefit. She complained at the time of admission, four weeks ago, of frequency and burning on urination. The frequency was especially marked at night. This nocturia, as the nocturnal type of frequency is termed, greatly disturbed her sleep. The urine contained a large amount of pus, and smears revealed the presence of Gram-negative bacilli resembling Bacillus coli. The bladder was fairly tolerant to fluid. The mucosa was diffusely dull red, indicating a wide-spread infection. The trigone showed changes which are considered typical for an infection of long standing, in the form of pale, fog-like edema and redness of a darker tint than one sees in more

acute cases. These changes were enough evidence upon which to base a diagnosis of chronic cystitis. The question arose, however, why should such a condition persist in spite of all local treatment. A glance at both ureteral orifices sufficed to explain the futility of measures directed at combating the infection in the bladder alone. The lips of both ureteral orifices were very edematous and prominent. The orifice itself on each side gaped widely (Fig. 109). Both of these changes, easily detected on cystoscopic examination, were due to infection of the upper urinary tract.

Further urologic study revealed the presence of a bilateral ureterorenal infection due to multiple bilateral ureteral strictures. Dilatation of the latter followed by lavage of both renal

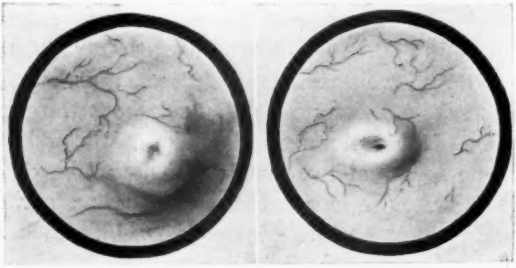

Fig. 109.—Wash drawing showing cystoscopic appearance of ureteral orifice in 2 cases of pyelitis. Note in the left-hand view the prominence of the orifice and in the right-hand view the gaping character of the orifice. Either or both of these are typical of the presence of infection in the renal pelvis and ureter.

pelves twice a week, using 1 per cent. nitrate of silver, has already resulted in a very marked improvement in the symptoms and degree of pyuria. The intervals between such treatments will be gradually lengthened. We cannot hope for a complete relief of the condition owing to the almost irreparable damage to the ureteral wall. Had the reno-ureteral etiology of her cystitis been recognized at any earlier period of its evolution, the prognosis would have been correspondingly better.

The second of these female patients is also an instructive example of the necessity of constantly keeping in mind the fact that comparatively few cases of cystitis, especially in women,

are primary in the bladder. This patient, a woman of thirty, began to notice about three years ago, that she was obliged to get up more frequently at night to urinate than had been the case previously. Soon afterward she noticed that the desire to urinate recurred about every two hours during the day. Recently, that is, during the past year, there was pain accompanying and following urination and occasionally a few drops of blood at the end of urination. She had consulted a physician in her city, who prescribed urinary antiseptics and irrigated the bladder. She was sent to us with the diagnosis of a chronic cystitis. We found

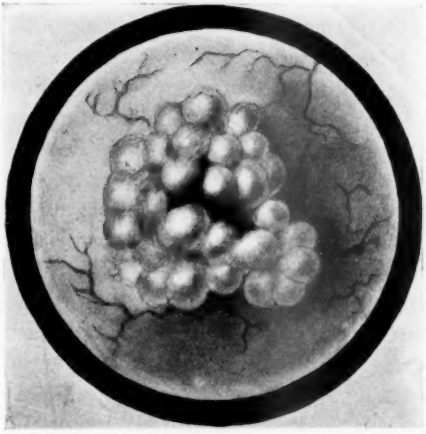

Fig. 110.—Wash drawing of bullous edema of lips of ureteric orifice as seen in some cases of renal tuberculosis.

the urine quite turbid. Microscopically many pus-cells were found, and smears of the centrifuged sediment revealed in addition to Gram-positive cocci a fairly large number of tubercle bacilli. A satisfactory cystoscopy was only possible under caudal anesthesia. Before this type of anaesthesia was employed the bladder capacity was less than 100 c.c., but this was greatly increased by this method of anesthesia which is to be warmly recommended for the examination of bladders with poor tolerance for the amount of fluid which is indispensable for cystoscopy.

The bladder mucosa changes were indistinguishable from those of a chronic non-tuberculous cystitis. The right ureteral orifice showed a marked bullous edema (Fig. 110) so frequently seen in renal tuberculosis. The urine on this right side contained many pus-cells and tubercle bacilli. On the opposite side the urine was clear and without bacteria. Pyelography on the right side revealed the changes which are considered typical of tuberculosis.

At operation our diagnosis of a right sided renal tuberculosis was confirmed. The prognosis in this case is good because the renal changes were not very advanced. We know that 60 per cent. will remain permanently cured if a diagnosis is made when the disease is still unilateral. This case emphasizes the necessity of always remembering that about 65 per cent. of all cases of renal tuberculosis present clinically under the picture of a chronic cystitis. The frequency and pain on urination are the outstanding features of this picture. In no other form of cystitis is the frequency so marked. The bladder changes are often comparatively slight even when the frequency is marked.

We have a number of cases on our service where the symptoms of cystitis can be readily explained by the presence of obstruction in the urethra (stricture) or at the bladder neck. The same is true of cases of calculus, diverticulum, or tumor of the bladder. The diagnosis in such cases is comparatively simple and I will not attempt to present examples of this class today. Before closing, however, I wish to call attention to one more patient and then place on the blackboard a brief outline of this subject of cystitis.

This last patient entered about ten days ago, complaining of severe pain, burning and frequent urination. She is twenty-five years old and denies venereal infection. No attempt was made at the time of admission to do more than alleviate her distressing symptoms. This was accomplished very quickly by alkalinizing [1] the urine, frequent hot sitz-baths, an electric pad

[1] We give 15 grains of potassium citrate, 5 minims of tincture of hyoscyamus in 1 teaspoonful of elixir saw-palmetto et santali compound (Parke, Davis & Company, or Lilly) every four hours.

over the suprapubic region, opiates [1] and only liquids, especially hot tea (linseed and camomile). Now that the acute symptoms have been relieved, we will proceed to make an examination of the genitalia, especially the cervix uteri, urethra, bladder, and upper urinary tract to ascertain the etiology of the cystitis. A fairly large number of cases of cystitis in young women are due to an endocervicitis whose purulent secretions are easily carried to the urethra. The following outline may be of service to you in the future:

Causes: (*a*) Ordinary pyogenic bacteria; *e. g.*, Bacillus coli, streptococci, staphylococci, gonococci, and urea-decomposing organisms.

(*b*) Tubercle bacillus.

(*c*) Chemicals (often used as abortifacients).

(*d*) Thermal and electrical causes.

(*e*) Non-bacterial, *e. g.*, ameba coli, bilharziosis, and syphilis.

Modes of infection: 1. Urethrogenous route.

(*a*) From posterior urethra, prostate, and vesicles (seminal).

(*b*) Unclean instruments.

2. Descending route, *i. e.*, from kidney and ureter.

3. Hematogenous route, *i. e.*, via blood-vessels of bladder (rare).

4. Lymphogenous route, *i. e.*, from prostate, seminal vesicles, and rectum (all very rare by this means).

5. By way of fistulæ between bladder and adjacent viscera, including persistent urachus.

6. By reflux (from upper urinary tract).

Predisposing factors in cystitis: (*a*) Presence of blood-clots, calculi, foreign bodies, and tumors.

(*b*) Obstruction at vesical neck, trigone, or in urethra.

(*c*) Residual urine (cystocele, pregnancy, operation, etc.).

(*d*) Atony of the detrusor muscle (central or peripheral origin).

Pathologic and Cystoscopic Changes.—Acute cystitis, hyper-

[1] A suppository containing ¼ grain each of extract of belladonna and opium is given every four hours until pain is relieved.

emia, or punctate hemorrhages; later, diffuse or circumscribed edema, and redness. At times, extensive hemorrhages or multiple minute ulcers (rare in acute cystitis).

Chronic cystitis with chiefly involvement of the mucosa.

(*a*) Ulcerations with or without diffuse or localized redness and edema.

(*b*) Cystitis cystica and glandularis changes in mucosa.

(*c*) Cystitis granularis changes.

(*d*) Granuloma formation.

(*e*) Edema bullosum.

(*f*) Leukoplakia formation.

Chronic cystitis with predominant involvement of the submucous and muscular coats.

(*a*) Very little involvement of mucosa.

(*b*) Development of Hunner ulcers.

Symptoms: Acute Cystitis: (*a*) Cases in which pain, frequency, and pyuria predominate.

(*b*) Cases in which hematuria predominates.

Chronic Cystitis: Combinations of every conceivable degree of severity of pain related to act of urination, frequency, and pyuria.

Diagnosis: From above clinical pictures plus complete urologic study as soon as acute symptoms disappear.

Treatment: Acute Cystitis: Palliative (see remarks under last clinical case), later irrigations, using small amounts at each injection.

Chronic Cystitis: Eliminate cause, if possible.

Urinary antiseptics.

Alkalinizing and acidifying urine during alternate weeks.

Electrocoagulation of ulcers of Hunner type.

CLINIC OF DR. CARL A. HEDBLOM

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RESEARCH HOSPITAL

THE SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS[1]

THE surgical treatment of pulmonary tuberculosis is attracting an increasing measure of attention throughout the civilized world. The generally accepted indications are chronicity, unilateral pulmonary involvement, adhesions preventing pneumothorax collapse, and a general condition sufficiently good to withstand a one or two stage operation. In practice only a relatively small proportion of patients are seen who present such ideal indications. If thoracoplasty is limited to such patients a large proportion of them will be denied the only chance of recovery. Some degree of bilateral involvement, extrapulmonary tuberculosis of mild grade, pleural effusion, hemorrhage, and a degree of activity making the patient a relatively poor surgical risk do not necessarily constitute contraindications for surgical collapse provided the treatment is individualized.

The cases to be presented are selected as examples of some such types of pulmonary tuberculosis.

Case I.—Mr. J. G., a married Jewish-American salesman, age twenty-six years, referred by Dr. I. Trace, entered the Augustana Hospital on May 12, 1926, complaining of cough, sputum, weakness, and loss of weight of two and a half years' duration.

In January, 1924 he developed a cough and began to feel tired upon slight exertion. After growing steadily worse, for one month, he consulted a physician who told him that he had tuberculosis of the left lung and sent him to a sanatorium. He

[1] From the Department of Surgery, University of Illinois Research Hospital, Department of Surgery, Augustana Hospital, and from the Department of Surgery, Municipal Tuberculosis Sanitarium.

stayed there for five months and during the last month pneumothorax treatments were started. He improved so promptly and so markedly that he was sent home where pneumothorax treatment was continued for eighteen months, at the end of which time he weighed 175 pounds. He became less regular about his pneumothorax refills. The lung re-expanded and became adherent, so pneumothorax treatment had to be abandoned.

In May, 1925 he started to work, but had to give it up after three months because of loss of weight and a rise in temperature. He gradually improved and regained his weight. Since then he had been about the same—fairly well and able to be up and about, but easily fatigued and unable to get back to work. He raised 11 ounces of sputum in twenty-four hours.

Physical examination showed practically no abnormal findings other than those in the thorax. Examination of the chest showed moderate retraction and limitation of motion of the left side with signs of extensive involvement of the lung, extending well toward the base. In the right lung there were no signs of involvement.

The first stage thoracoplasty was performed on May 13, 1926, at which time the lower four ribs were resected. He stood the operation so well that the second stage was performed three days later when 10 to 12 cm. segments of the third, fourth, fifth, and sixth ribs were resected.

On the second day after the operation his temperature rose to 103° F., and the pulse and respiration became rapid. Examination of the wound showed severe infection throughout its length. Dakin tubes were inserted and two hourly irrigations commenced. In spite of this he grew worse and consequently on May 21, 1926 the wound was opened widely and Dakin tubes and packs applied. Following this the patient improved gradually, his wound cleared up, and secondary suture was performed on June 9th. The thoracoplasty was completed on June 26th, and he was discharged twenty-eight days later.

On September 1, 1926 he came to the hospital for observation. He was still taking things easy, resting part of the day, and taking short walks. He reported a gain of 30 pounds since the

operation. The few râles which were present in his right lung at the time of discharge had disappeared. He had no fever.

The patient has been under close observation since this time. He has remained entirely symptom-free to date, has gained 56 pounds in weight, and during the last year has been back at work at his old occupation.

Comment.—This patient presented the ideal indications for thoracoplasty—the most favorable age, chronicity, unilateral pulmonary involvement, clinically speaking, without evidence of extrapulmonary lesion. He was in good general condition, but a semi-invalid and raised a large amount of sputum containing tuberculosis bacilli. Incidentally his case illustrates the value of pneumothorax collapse, but also one of the limitations of that treatment.

The accidental infection in the wound following the second stage operation was of such severity that had it complicated a complete thoracoplasty wound the patient probably would have succumbed. Wound infection in thoracoplasty should be guarded against as rigidly as in case of a bone graft or brain operation.

Case II.—Mr. W. K., a married American farmer, about forty years of age, entered the Augustana Hospital November 21, 1927, complaining of cough and sputum. He was referred by Dr. Dunham, Ottawa, Illinois.

His present illness began in 1920 when he began to feel tired and developed a slight hacking cough which continued during the next three years, but he was able to work though easily fatigued. In September he consulted a physician because of increasing weakness and was told he had lung trouble and was given a tonic. In October the cough became productive and more troublesome and he began having night-sweats and lost weight rapidly. In November he was sent to a sanatorium where he remained in bed for eleven months.

In October, 1926 while still at the sanatorium he had repeated hemoptyses and was at this time transferred to the Ottawa Sanatorium where the right lung was collapsed. He had no more hemorrhages following this treatment and he improved

markedly, although he developed a perirectal abscess. The further pneumothorax treatment was complicated by a pleural effusion which became purulent.

Examination showed the findings of a pyopneumothorax on the right with a considerable portion of the upper lobe uncollapsed and containing a cavity. Moist râles were heard over the left upper lobe anteriorly and posteriorly. The sputum which averaged 2 ounces in twenty-four hours was laden with tuberculosis bacilli.

On November 23, 1927 a 10 cm. segment of the phrenic nerve was extracted. An extrapleural thoracoplasty was then performed in three stages about one week apart; 300 c.c. of sterile pus was aspirated preceding the first operation, and about 100 c.c. after the second. He withstood the thoracoplastic operations very well, and improved steadily up to the time of his discharge to the Ottawa Sanatorium January 17th.

He was there until August 18th when he was allowed to return home. Dr. Dunham reported: "His condition at that time was very good and examination of the sputum did not show the presence of tuberculosis bacilli. The physical findings were about the same as they have been on recent examinations. (A few râles at the apices on both sides.) He weighed 156½ pounds at the time of his discharge making his total gain in weight since leaving Chicago of 29 pounds."

Comment.—The indications for thoracoplasty in this case were a persistently active tuberculous process with cavity formation in an uncollapsed right apex, and a tuberculous empyema complicating pneumothorax treatment. Unfavorable findings were moist râles anteriorly and posteriorly over the upper portion of the left "good" lung, and a persistently draining tuberculous fistula in ano.

The gain in weight, freedom from fever with unrestricted exercise, disappearance of tuberculous bacilli from the sputum, healing of the fistula in ano, and general well being seem to justify the expectancy of a permanent cure.

Case III.—Miss H. W., an American nurse, about thirty-

four years of age, entered the Augustana Hospital September 20, 1927, referred by Dr. Dunham of Ottawa, Illinois. Her chief complaint was cough and pain in the chest.

Her father died of pulmonary tuberculosis at the age of fifty-one. The patient had had cervical glands removed in 1903.

Her present illness began in June, 1923 when she developed a dry unproductive cough, but without other symptoms. In August she began to raise mucopurulent sputum. In October she developed fever, and left sided pleurisy which kept her in bed a few days. She then worked again until June, 1924 when she again had fever, pleurisy, and lost 10 pounds in weight. She was then sent to a sanatorium where she was kept in bed for six weeks, after which she was ambulatory for the rest of her nine months stay. She gained 8 pounds in weight while there. After five months at home she was again in a hospital six weeks on account of recurrence of symptoms. During a subsequent eight months sojourn in Arizona she gained much in weight and strength. On her return home she resumed nursing on half time basis, but at the end of six months, had another relapse lasting five weeks and still another four months after again resuming work. This latter relapse was in May, 1927. She was in bed since, running a consistent fever which the last weeks had fluctuated between 100° and 104° F. She raised 2 ounces of sputum in twenty-four hours which was loaded with tuberculosis bacilli.

There was marked retraction of the left chest with dulness to percussion throughout except for tympany below the right clavicle and high in the axilla. There was bronchial breathing anteriorly and posteriorly and signs of a cavity under the tympanitic area. At the base anteriorly and posteriorly there was flatness to percussion and absent breath-sound and tactile fremitus.

The patient was considered a distinctly poor risk for thoracoplasty, but it was hoped that some improvement might result from a phrenico-exeresis, and that in any event it would serve as a test operation.

The full length of the phrenic nerve was extracted on September 27th. Immediately after the operation the patient volun-

teered the information that she coughed up the sputum more easily than before. During the first ten days after the operation the temperature fell to normal the first time for four months and her general condition improved so markedly that a more complete collapse of the lung seemed indicated. A four-stage posterior extrapleural thoracoplasty was performed on October 3d, 10th, 17th, and November 17th, respectively. The patient withstood these operations remarkably well considering her poor condition at the beginning of her operative treatment. She was discharged to the Ottawa Sanatorium November 19, 1927.

On June 22, 1928 Dr. Dunham reported by letter: "Examination of Miss W.'s. chest this month does not reveal any evidence of moisture in other lung. She now weighs 118 pounds making a total gain of 24 pounds since her return from Chicago. She is now taking three meals a day in the dining room, sitting up about six hours a day, and walking nine blocks. Her temperature is normal."

She was later discharged from the sanatorium symptom free.

Comment.—Repeated exacerbations of symptoms indicating recurrent activity of the tuberculous process, and prolonged persistent fever, weight loss, and weakness at the time of her examination, made it very questionable as to whether thoracoplasty should be attempted in this patient even in multiple stages. A phrenico-exeresis served here as a test operation. The cessation of fever within ten days after this operation for the first time in four months was taken as indication that more complete collapse would result in further improvement. The patient withstood the last of a four-stage operation better than the first. Gain in weight of 24 pounds, freedom from fever, even though she is about all day as contrasted with consistent fever even though completely bedridden before operation, seem to justify the expectation of a permanent arrest of the disease.

Case IV.—Miss F. F., a single American student nurse, twenty-six years of age, entered the Municipal Tuberculosis Sanatorium September 9, 1927, with a diagnosis of pulmonary tuberculosis.

In June, 1927 she had a "cold" and began to feel weak and tired, and was found to have a temperature of from 99.6° to 101° F. She had been in bed ten weeks before she entered the sanatorium. During this time she had lost 14 pounds.

At the entrance examination she was found to have an advanced grade of tuberculosis of the left lung, but the findings in the right lung were normal. The sputum contained tuberculosis bacilli.

She showed no improvement from complete rest in bed. Artificial pneumothorax collapse was then attempted unsuccessfully.

A phrenico-exeresis was then done in the hope that some improvement might result from the resulting partial collapse.

She then developed profuse recurrent hemoptyses, high fever, nausea, and vomiting, and marked prostration. Ordinarily she would have been considered in far too poor condition for thoracoplasty; but it remained the only hope of checking the exsanguinating hemorrhages.

The patient was brought to the operating room anemic, dehydrated from vomiting, and prostrated. Her pulse was 150, temperature 103° F. She had had a hemorrhage a short time before.

The posterior extrapleural thoracoplasty was performed in three stages one week apart. At the first one, March 14th, 3 to 8 cm. segments were resected from the first to the fifth ribs inclusive. By resecting the upper ribs first an initial partial collapse was obtained of the cavity in the upper lobe from which presumably the hemorrhage came. The patient improved so remarkably after this first stage that the second stage operation seemed justifiable a week later, and she was in still better condition for the third stage operation a week after that.

Her further improvement was rapid and steadily progressive. On May 14, 1926 she was gaining in weight and strength, temperature normal, pulse 90 to 104. The findings in her right lung were normal.

Comment.—This patient represented a relatively very unfavorable type of case for thoracoplasty. The fever, progressive

weight loss, and weakness indicated a rapidly progressive lesion. Profuse recurring hemoptysis and persistent vomiting made the patient a desperate risk, but the bleeding was so profuse that thoracoplasty was undertaken as the only means for its control. The thoracoplasty was begun from above in order to secure collapse first of the cavity in the apex from which the bleeding came. She withstood the third of the three-stage operation better than the first.

Her improvement since the operation has been remarkable. She has no cough or sputum, no fever, although she is up and about every day, and has had no recurrence of hemoptysis. She has gained 40 pounds in weight and is the picture of health.

Case V.—I. L., a single machinist, twenty-seven years of age, entered the Research and Educational Hospital of the University of Illinois, December 7, 1926, because of cough with purulent sputum and recurrent hemoptysis.

His present illness began two and a half years before when he had an attack of scarlet fever from which he failed to make a complete recovery. Six months later, following a cold, he developed fever, cough, night-sweats, weakness, anorexia, and weight loss. After a month in bed he returned to work. On the second day he had a profuse hemoptysis. After five weeks in a general hospital, he was transferred to the Municipal Tuberculosis Sanatorium where he had repeated hemoptyses. The symptoms subsided gradually, but incompletely.

A year after the onset of symptoms the seventh to eleventh ribs were resected subperiosteally for a right basal tuberculosis. He improved markedly following this partial lung collapse, but hemoptyses and other symptoms persisted, and the sputum remained positive for tuberculosis bacilli.

Physical examination on admission showed regeneration of the resected ribs, but considerable narrowing of the right lower thorax. At the right base, posteriorly, just below the angle of the scapula there was dulness, increased tactile fremitus, moist consonating râles, and cavernous whispered and spoken voice.

There were no abnormal findings over the right upper lobe nor over the left lung.

The sputum showed tuberculosis bacilli, the temperature was 99° F., pulse 90, respirations 20. Vital capacity was 2600 c.c.

The persistent symptoms and the findings of a cavity in an incompletely collapsed lower lobe pointed to the necessity for a more complete collapse of the diseased lung.

A four stage posterior extrapleural thoracoplasty was performed during a period of two months including a resection of the regenerated previously resected lower ribs. He tolerated the operations only fairly well in spite of the fact that only three ribs were resected at each of the first three sittings and it was necessary to wait two weeks between the second and third stages and four weeks between the third and fourth stage.

The lung was still incompletely collapsed in spite of the fact that from 4 to 12 cm. segments of the ribs were resected. A secondary complete costatectomy of the second to the eleventh ribs inclusive was then done in two stages through a midaxillary incision at intervals of two weeks, the first one, four weeks after the completion of the posterior resection. This resulted in a very extensive collapse especially of the lower lobe which was chiefly involved.

The patient withstood the secondary costatectomy better than the preceding posterior resection, and began at once to gain in weight and strength. He was discharged from the hospital in excellent condition on March 11th. No tuberculous bacilli could be found in the sputum at that time.

On July 30th the patient presented himself for examination. He had no fever or cough, and showed a weight gain since leaving the hospital of 26 pounds. There was no abnormal findings in the left lung.

Comment.—The case of this patient illustrates the necessity for a relatively complete collapse of the lung in some cases in order to achieve a cure. It also points the way to obtain such an extensive collapse by the removal of the remaining anterolateral segments. This can be done through a midaxillary incision which avoids sectioning of any of the important thoracic muscles.

A short cross incision over the ninth interspace, however, aids in the exposure of the lower rib segments. In my experience, patients uniformly withstand this secondary costatectomy better than the posterior resection. By its use as complete a collapse is obtained in cases in which the posterior resection has proved inefficient as following the most successful posterior thoracoplasty only.

Case VI.—A. R., a single woman, thirty-nine years of age, entered the Wisconsin General Hospital April 9, 1925 with a history of pulmonary tuberculosis and symptoms of exophthalmic goiter.

While between ten and twelve years of age she was ill with a "chronic bronchitis." She had pneumonia at the age of seventeen, and influenza and pneumonia in 1920. She had been associated with a woman who later died of pulmonary tuberculosis.

In 1920 a diagnosis had been made of pulmonary tuberculosis and she had a pneumothorax collapse which had been kept up until the time of her admission, *i. e.*, five years. She had improved perceptibly following this pulmonary collapse, and had been in fairly good health until the onset of her present complaint.

For a year previous to her admission she had noticed increased dyspnea on exertion, palpitation, nervousness, increasing irritability, and heat intolerance. She had not lost much in weight nor had her appetite increased perceptibly.

On examination she was found to have a little enlargement of the left lobe of the thyroid. A thrill could be made out near the left lower pole, but no bruit. The pulse ranged between 100 and 110. There was a slight exophthalmus, impaired eye convergence, and definite lid lag.

Chest examination showed a marked retraction of the whole left thorax. The percussion and auscultatory findings were those of a pneumothorax except for bronchial breathing, tactile fremitus, and coarse râles near the apex posteriorly, suggesting adhesions of the lung to the chest wall in this area.

The right "good" lung showed compensatory emphysema

with dulness and fine moist râles at the apex suggesting a tuberculous involvement there.

The diagnosis was old left pulmonary tuberculosis with almost complete pneumothorax collapse, right apical tuberculosis, with questionable degree of activity, and a complicating exophthalmic goiter.

She was put on Lugol's solution and arrangements were made for pneumothorax refills at intervals of a few weeks. The intrapleural tension was always negative at one time reaching between 25 and 30 cm. water pressure as measured by a specially constructed water manometer. On August 24th the basal metabolic test was +30.

On September 18th a subtotal thyroidectomy was performed under local anesthesia. The convalescence was entirely satisfactory. She was given a pneumothorax refill on the eighth day and discharged home on the twelfth day following this operation. The metabolic rate dropped to normal and other symptoms attributed to hyperthyroidism abated promptly.

She returned for pneumothorax refills at intervals. On February 16, 1926 roentgenogram showed heart and trachea displaced to the left. The left lung was completely collapsed except for an adherent portion above and medial to the first rib. The right lung showed increased density of the peribronchial structures throughout with a calcified nodule well out in the parenchyma. A few moist râles were always to be heard over the upper right lung.

During the first half of 1927 she had an increased amount of cough and sputum, occasionally blood streaked, and some loss of weight. During the summer she had a number of teeth extracted in two stages. Following the second sitting she had a violent reaction characterized by chills, fever, and much local inflammatory reaction.

In August, 1927 she was found to have a pleural effusion, and 500 c.c. straw-colored fluid was withdrawn. On September 18th she entered the Augustana Hospital where a four-stage extrapleural thoracoplasty was performed during a period of sixteen days. She stood these operations fairly well except that she had

some dyspnea and some difficulty in raising the sputum after each operation. The intrapleural tension was reduced to atmospheric by means of the pneumothorax apparatus. Attempt to aspirate fluid after the last operation was unsuccessful.

A roentgenogram showed an incomplete collapse of the pneumothorax cavity after this posterior thoracoplasty. During October, 1927 a subperiosteal resection of the seventh to the tenth ribs was then performed in one stage. Following this operation she developed fever and increasing dyspnea and leukocytosis. Exploratory aspiration revealed a purulent effusion, a smear and culture of which showed staphylococci. A catheter was then introduced and the cavity irrigated with Dakin's solution. The temperature promptly became normal and the dyspnea disappeared.

On January 9th the remaining segments of the upper five ribs were then resected through a midaxillary incision. Dakin's solution was continued and nine days later the residual 100 c.c. cavity was unroofed by resecting the overlying thickened pleura and intercostal bundles. The cavity was now completely obliterated. She was discharged home March 2, 1928 in good general condition.

She returned for inspection on April 17, 1928. The wound was healed except for superficial granulations. She had been up and about every day, had no fever, and only slight cough, and sputum which did not show tuberculosis bacilli. She had gained 40 pounds in weight.

Comment.—The case of this patient is illustrative of the difficulties that may beset the surgical treatment of pulmonary tuberculosis, but also shows that the treatment, if it fulfills the indications, may eventually be as successful as in a simpler condition.

It is an example of the failure of the lung to re-expand after years of pneumothorax collapse, of the high degree of negative tension that may develop, and of the pleural effusion which may occur after years of freedom from it.

By way of treatment this case also illustrates the necessity for complete costatectomy for the obliteration of a cavity fol-

lowing complete fixed lung collapse, the value of Dakin's-solution irrigation in the treatment of secondary infection, and finally a method of securing complete obliteration of a residual cavity by resection of the overlying thickened pleura and intercostal bundles.

Such extensive surgical collapse in a debilitated patient cannot be carried to a successful conclusion except by a graded operation, the extent of each succeeding operative procedure being determined by the patients condition at that time.

It seems worthy of note also that the lesion in the good lung was not stirred up to increased activity by the multiple stage operation.

CLINIC OF DR. FREDERICK B. MOOREHEAD

PRESBYTERIAN HOSPITAL

BONE GRAFT TO JAW

THIS patient met with a severe automobile accident May 13, 1927. Among other injuries he sustained a double compound

Fig. 111.—Showing defect in jaw after removal of sequestra.

fracture of the lower jaw (*a*) through the angle, backward from the third molar to a point slightly above the angle, and (*b*)

between the left lateral incisor and cuspid teeth. Because of the gravity of other injuries, no attempt was made to manage the jaw fracture. A rather severe infection developed in both fractures, and the patient was brought from a southern hospital to Chicago August 26, 1927. Free external drainage was established in both abscesses. Hot packs were applied at regular intervals, and both wounds inside the mouth were irrigated twice

Fig. 112.—Showing extensive necrosis of the right lower jaw at the angle.

daily with a weak iodosaline solution. Sequestra were removed August 31, 1927 and September 9, 1927. The jaw was immobilized with an orthodontic appliance by Dr. B. O. Sippy. This held the lower jaw in accurate relation to the upper jaw.

It will be noted by *x*-ray film that there was a total loss of bone on the right side extending from the first molar to the distal

fracture, and a full half inch on the left side. During the healing process, the right ramus was pulled forward by muscular action until it came in contact with the malar eminence.

On May 24, 1928, six months after all trace of infection had disappeared, the tissues were opened and the posterior fragments brought back into position. After preparing a suitable bed, and freshening both ends of bone, a transplant of suitable size was

Fig. 113.—Showing bone transplant in place.

taken from the crest of the ilium and fitted accurately in place. Because of the tendency of the posterior fragment to pull forward it was necessary to fix the graft with two silver wire sutures at each end.

The wires were removed November 21, 1928, and we were delighted to find a deposition of bone of sufficient volume to form a satisfactory consolidation.

CENTRAL FIBROMA OF JAW

THIS patient entered the hospital four years ago with an extensive mass in the left upper jaw. It was hard, smooth, and painless. The *x*-ray showed nothing beyond an increased density. There was no fluctuation or crackling. An incision was made under the lip, exposing the anterior wall. On removal of the bone, a fibroma the size of a goose egg was removed.

Fig. 114.—*x*-Ray showing location of tumor in jaw.

She returns now with a similar swelling at the angle of the left lower jaw. The *x*-ray shows an apparent cavity in the bone with regular smooth wall. At first blush one would make a diagnosis of cyst. The absence of fluctuation or crackling, however, in a cyst of this size would be very unusual. Under block-anes-

thesia an incision was made over the crest of the alveolar ridge, exposing a hard, round, smooth tumor which was easily shelled

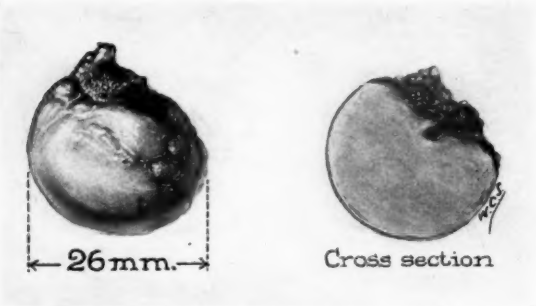

Fig. 115.—Drawing (actual size) of central fibroma of jaw.

out. On microscopic examination it was found to be a fibroma with occasional small islands of bone-like material.

CARTILAGE TRANSPLANT TO NOSE

THIS patient first came to us two years ago with a total absence of the nasal bones. The toes and fingers are also defective. Two operations have been made to restore the nasal defect. The first operation was made a year and a half ago. At that time a good-sized piece of cartilage was taken from the left costal arch, and inserted in the nose. The skin in the columella was punctured with a tenotomy knife, and a fine artery forceps introduced under the skin to the level of the inner canthi. By

Fig. 116.—Photograph before cartilage transplant.

Fig. 117.—Photograph after first and second transplant.

careful manipulation, a bed was formed and a properly shaped piece of cartilage introduced. The remaining cartilage was placed in a pocket under the skin before the belly wound was closed.

At the second operation the cartilage was removed from the belly wall, and another section was placed above the first cartilage transplant and in exactly the same manner. We now have two pieces of cartilage, one directly above the other, which serve

to pave the way for the final operation. The skin was too tense and thin to permit of more than moderate stretching at the beginning.

At the next operation we shall remove the cartilage transplant, and insert an L-shaped piece of rib, the long stem forming the bony nose, and the short stem the columella.

LYMPHANGIO-ENDOTHELIOMA OF LIP AND NOSE

A CHILD two years old was admitted to the hospital on our service February 9, 1928. There was a very hard mass involving the right upper lip, the columella, and wing of the nose. Two careful blood examinations showed no evidence of syphilis. A biopsy was made February 11th which showed no specific organization beyond the usual findings in a chronic inflammation. A second biopsy was made February 17th, and from this tissue a diagnosis of lymphangio-endothelioma was made. A number of *x*-ray treatments were given on the first admission, and the mass

Fig. 118.—Photograph on admission to hospital.

practically disappeared. At this time the parents were induced to put the child under the care of a "healer," and nothing was seen or heard of the case for several months.

The two photographs show the condition of the case on the first admission, and after returning from the healer about eight months later.

The father was opposed to a radical removal of the mass, and we rather agreed with him, on the ground that complete excision

meant literally the removal of two-thirds of the lip, and one-half of the nose, including the columella. Obviously no reconstruction could possibly make the child presentable, and this together

Fig. 119.—Photograph of child ten months later.

with the uncertainty of cure by radical surgery led to the use of *x*-ray treatments instead.

CARTILAGE TRANSPLANT TO MALAR BONE

A YOUNG woman, twenty-three years of age, was admitted to the hospital on the service of Dr. E. W. Pernokis for medical treatment. She gave a history of multiple osteomyelitis, occurring several years ago coincident with an attack of typhoid fever. Among the many lesions, two occurred on the face, one at the angle of the left lower jaw, and the other involving the left malar bone. At this point there was a very marked depression, with considerable scar tissue. The depression was cor-

Fig. 120.—Photograph showing defect in malar bone.

rected by the insertion of a suitable sized piece of cartilage, taken from the left costal arch. The skin was punctured with a tenotomy knife at a point distal to the depression. A small blunt chisel was inserted and the skin carefully dissected from the bone at all points. The opening was then stretched with a small artery forceps, and a piece of cartilage inserted into the bony depression. This completely eliminated the defect and restored the normal

Fig. 121.—Photograph showing defect removed after cartilage transplant.

contour. At a later date the scar will be revised in the usual manner.

CLINIC OF DR. EDMUND ANDREWS

ST. LUKE'S HOSPITAL

MULTIPLE CARCINOMATA IN ABERRANT BREAST TISSUE

THIS patient is seventy-nine years of age, and has been under my observation for ten years. In 1918 she was first seen complaining of a painful swelling in the left axilla. This had been noticed but a few weeks before, and had grown rapidly and was quite painful. The pain radiated down the arm, and on to the chest. Motion of the right arm caused marked distress. At that time her history was otherwise entirely negative. She had had two children, and while nursing them had had no pain or swelling in the axilla.

Examination revealed a very hard nodular mass about the size of a hen's egg lying rather high in the left axilla. It was irregular and very tender to touch. It was, however, very freely movable, and no glands could be palpated distinct from the mass. Careful examination of both breasts showed no primary tumors and the diagnosis of primary tumor of the axilla was made.

At operation the mass was easily removed. While it had no distinct capsule and blended into the loose areolar tissue it was not adherent to any of the adjacent structures. A complete axillary dissection was made and no enlarged glands discovered.

The pathologic report of this tissue was a diagnosis of carcinoma of the breast of the glandular type. What appeared to be normal breast tissue was present in a few fields, but mostly there were atypical acini with multiple layers of cells and no distinct basement membranes. Many fields were made up almost wholly of irregular masses of cells of a typical carcinomatous appearance.

The wound healing was normal, and nothing more was heard of the patient for two years when she came in with a small re-

currence in the posterior axillary fold about 3 inches from the original incision. This mass was loose and movable, and lay under the skin on the border of the latissimus dorsi muscle. It was removed without difficulty under local anesthesia, and proved to be essentially similar to the former growth on microscopic examination.

The condition of the patient now presents an interesting problem. She now has a growth just below the right breast. It is very hard and quite firmly adherent to the underlying fascia. It appears to be entirely separate from the gland. Examination of the other axilla and breast reveals nothing. Both wounds are firmly healed and the skin is quite movable. No masses or tenderness can be found. The left arm is slightly larger from lymphedema, but is not sore or cumbersome. There is no limitation of motion. The skin about the two incisions is much tanned from the heavy radiotherapy which has been administered at intervals since the last operation.

It is a real problem what to do in this case. The breast is apparently normal, but the tumor is so close that leaving it seems risky. Still the patient is nearly eighty years old and I feel that all possible conservatism is indicated. She is perfectly well in every other respect however, the heart, lungs, and kidneys being normal. Blood-pressure is 130/85.

I am, therefore, going to make an incision in the axis of the ribs over the tumor just below the breast, and be guided by what I find inside. I am now directly on the tumor. It is smaller than a walnut, but seems to be firmly embedded in the fascial covering of the pectoralis major almost at its lower border. On more thorough exposure, it is seen to involve not only the fascia but to be infiltrating the red muscle beneath. There is no capsule and I assume that it is a carcinoma the same as the others. The breast tissue is at least an inch away and does not appear to be involved at all.

Of course this case calls for judgment in a field in which we have very little past experience to go on. No matter what one does or does not do he may be criticised for it later if the results are not good. I feel here, however, that the breast is probably

not compromised. This is her third cancer of the breast and she still has both breasts apparently normal. About the muscle, however, I am not so sure. The rich lymphatic supply of the pectoral muscle is well known, and as it leads to the axilla, it seems reasonable to assume that there is danger from that quarter. I am going, therefore, to leave the breast and remove the muscle, at least the lower half of it. In order to do that, it is necessary to extend the incision up toward the axilla. Then after cutting loose the origin of the fibers of the lower half of the pectoralis I am stripping it up from its bed to its insertion in the humerus. The axilla is now fully exposed, and it can be thoroughly inspected. Careful search reveals no glands and I feel that enough has been done. The wound is closed without drainage.

Discussion.—This brings up the age-old problem of multiple carcinomata. One can never say for sure whether they are really multiple primary tumors or simply recurrences of the first one. I believe in this case we have fairly good evidence that the third growth at least was really primary. In each case the pathologist did not know the source of the tumor, and each time made a diagnosis of carcinoma of the breast, and found normal as well as carcinomatous mammary tissue. There is no reason to assume that any secondary growth would not affect the normal as well as the aberrant breast tissue remnants. The fact that the other tumors did not kill the patient in spite of local removal each time warrants us in making a rather good prognosis this time.

Pathologic Diagnosis.—Adenocarcinoma of the breast.

Subsequent Course.—The wound healing was normal and the patient left the hospital on the fifth day. Heavy radiotherapy was instituted at once and is still being carried on. Seven months after the operation there was no sign of recurrence.

CLINIC OF DR. GATEWOOD

PRESBYTERIAN HOSPITAL

CHOLEDOCHODUODENOSTOMY FOR OBLITERATIVE STENOSIS OF THE COMMON DUCT

THE patient I wish to show you is a widow, fifty-three years old, who entered the hospital on the service of Dr. L. C. Gatewood and has been under the care of Dr. E. D. DuBois for the past week. Her complaints were, first, jaundice which has been present for the past three months, second, itching, especially at night and, third, loss of weight. Except for attacks of what she thought were indigestion, the patient has been in good health most of her life. These have occurred for the past twenty years as short attacks with moderate pain beginning in the epigastrium and leading around under the right costal margin. The pain occasionally has come on an hour or two after meals. It has never been severe enough to require morphin. Eleven months ago she had an attack which lasted two days, and although the pain was not severe she was definitely jaundiced. A month later she had another attack which kept her in bed for eight days. Following this she was operated upon and told that her gall-bladder was removed together with many stones. This operation took about three hours according to the patient, and evidently some difficulties were encountered by the surgeon. However, the patient made a good recovery and worked until three months ago when she again became jaundiced. There was no pain and, although the jaundice persisted, it was some weeks before she had any other symptoms. She became more languid, finally developing almost daily chills followed by considerable fever. Her maximum weight was 155 pounds. Her weight at the present time is 103 pounds. Her appetite is poor. Stools are occasionally clay colored, but usually brown.

Physical examination shows a markedly emaciated woman with very icteric skin. The right pupil is larger than the left, but both react to light and accommodation. The abdomen is scaphoid. The liver and spleen are not palpable. There are numerous ecchymotic spots over the extremities.

We are dealing here with a case of silent jaundice following presumably a cholecystectomy. There are several things in the laboratory examination which may aid us in our diagnosis. The patient's hemoglobin is 70 per cent., red blood-cells, 3,800,000; white blood-cells, 8450; blood-pressure, 124/66. Coagulation time, ten and one-half minutes. The Wassermann is negative. Van den Bergh shows a positive immediate direct reaction. A number of stools are negative for bile by the bichlorid test. There is chemical blood in all of the stools. The icterus index is 60. Urinalyses are negative except for the presence of bile. Fluoroscopic examination reveals no defect in the stomach or duodenum, and cholecystograms of the gall-bladder fail to show any filling or any evidence of stones.

To make a preoperative diagnosis requires the consideration of a number of possibilities. The history of gall-stones would make one consider, first, stones in the common duct. Judd[1] has called attention to the fact that colic does not always occur in common duct stone cases. The history of chills and fever would lead one to suspect an inflammatory process, that is, cholangitis with Charcot's hepatic fever. This, of course, might occur with or without stones. However, the patient's temperature has been normal for the week she has been here under observation, so that we are reasonably sure that there is no serious infection at the present time. Chronic pancreatitis will also produce silent jaundice without pain. On measured intake the specimens of the patient's urine have shown very marked fluctuation in color. This is much more characteristic of ball-valve stone than of pancreatitis or cholangitis where fluctuation occurs much more slowly. Carcinoma of the pancreas is not a rare disease, and is typically silent in its onset unless there are complicating gall-stones. The jaundice, however, is progressive and non-fluctuating. Stricture of the common duct must also be considered. We

know that the previous operation was very much prolonged, and it is fair to assume that some unusual complication was encountered. Where a common duct is ligated or completely divided

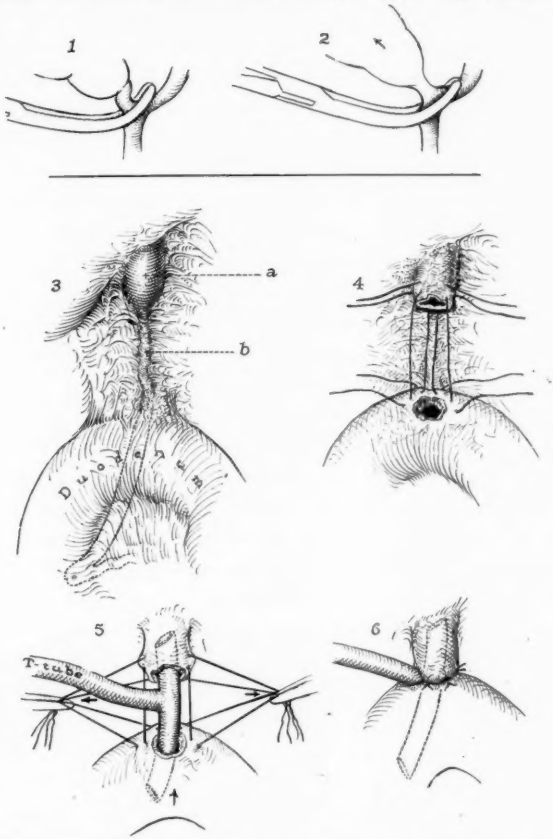

Fig. 122.—1, By improperly placing clamp on cystic duct stenosis of common duct may occur. 2, Illustrating how the common duct may be caught in clamp by traction on gall-bladder. 3, *a*, Dilated hepatic duct and *b*, stenosed portion of common duct. 4, 5, 6, Showing method of anastomosis of duct to duodenum over T-tube.

the result is apparent within a few days. But in cases in which the side of the duct has been pinched, as indicated in the dia-

gram (Fig. 122), the symptoms of stenosis may not be present for weeks or even months. Indeed, Judd states that it is not necessary to injure the duct to have stenosis occur, and in some cases it appears that generalized fibrosis of the hepatic system may follow an ordinary cholecystectomy. In such cases infection is not uncommon, and periods of jaundice accompanied by chills may be followed by temporary recovery lasting some weeks. Stones in the narrowed common duct may complicate the picture.

I do not believe that we can make an absolute diagnosis here. I have told the patient that she has some obstruction to her common duct which I believe is benign and which requires operative interference for relief.

Under ethylene anesthesia I am dissecting out the old scars I may say that in thin individuals we have been able to use ethylene, or ethylene with a few drops of ether, very satisfactorily. However, if the patient is rigid or obese, I feel that it is much wiser to employ straight ether than to force the ethylene anesthesia. Everything is frozen together so that dissection is very tedious. I have at last freed the duodenum and stomach from the liver and am searching for the common bile-duct. There certainly is no gross dilatation of the common duct such as one usually finds in cases of ball-valve stone. I have now freed what I believe is the free margin of the gastrohepatic ligament. The foramen of Winslow is completely obliterated by adhesions. Introducing a fine hypodermic needle, I withdraw dark blood, evidently from the portal vein. Just below the liver is a small, rounded pouch a little more than a centimeter in diameter. Introducing my needle into it I obtain light clear bile. Opening this pocket with a fine knife I am able to introduce a probe upward several centimeters. Taking a fine probe I can carry it downward along the course of the gastrohepatic ligament about 2 cm. Splitting downward, I find a very small tortuous tract which becomes almost a fibrous string. In attempting to follow this, I have freed it completely and torn it off from the surrounding scar tissue. After considerable hunting I have not been able to find the lower end of the common duct, although I know that

the duct must have been patent, as the patient has not had complete acholia. Were I to find the distal portion, there would probably be such a large gap that I could not unite the two ends. Therefore, I must make an anastomosis between the hepatic duct and the duodenum.

Several methods have been suggested for this operation. One of the most ingenious was suggested by Walton[2] in 1915 and modified by v. Stubenrach.[3] However, it seems to me that direct anastomosis is simpler and to be preferred wherever possible. I can mobilize the duodenum here very readily and bring it up to the stump of the duct. Walters,[4] in discussing secondary operations on the common duct, states that in the Mayo Clinic they have usually made an anastomosis over a rubber tube. Dr. L. L. McArthur[5] has repaired defects in the common duct over a rubber tube with a cuff to prevent its too early discharge. Having seen the tube pass out into the duodenum within a few days and stricture recur, I have preferred to use the T-tube method devised by Propping[6] in 1912. Although Walters states that in some instances secondary stricture has occurred after removal of the T-tube, we have not had that experience. In one case cholangitis developed secondarily. A bad cardiac condition made reoperation inadvisable. The patient lived some years with occasional attacks of jaundice and temperature, and finally died of myocarditis. The most serious objection to this method is the difficulty in removing the T-tube. This sometimes necessitates considerable exposure amounting to a second operation. The difficulties of making this anastomosis are considerable owing to the shortness of the hepatic duct stump. I have placed four Pagenstecher stitches through the lateral and posterior walls, and then inserted the stitches into the duodenum in the area in which I am going to make my anastomosis. This is the most difficult part of the operation. Inserting the short end of the T-tube into the hepatic duct, I am anchoring it with one catgut stitch. With a fine scalpel I have made a small opening into the duodenum. The other end of the horizontal part of the T-tube is readily inserted through this opening in the duodenum. Tightening my four stitches I have secured excellent apposition behind

the horizontal portion of the T-tube. To complete the anastomosis all that is necessary is to take a few mattress stitches in front of the tube. I am reinforcing my line of suture in front with a second row of fine catgut stitches, and then adding a tab of omentum to protect further against a leak. The abdominal wound is now closed in the usual manner bringing the catheter portion of the T-tube out at the upper angle. Bile is already coming from the T-tube, and the catheter end will be left open as a safety valve.

Just when I am to remove this T-tube is still a question in my mind. If left in place too long infection will be certain to ensue. If removed too early stenosis is a possibility. Experimentally, cholecystenterostomy is invariably followed by cholangitis. Clinically, some of these patients have gone over a period of years without any evidence of bile tract infection. If the patient makes a good operative recovery, I think I shall leave this tube at least eight or ten weeks before removing it.

In conclusion, we have done a choledocho-enterostomy for a traumatic stricture of the common duct, a long tedious operation carrying with it considerable risk. The patient is in good condition, and while there has been some oozing, there has been no hemorrhage. This has been obviated by the preoperative preparation which is all important. We have employed essentially the method outlined by Walters,[8] that is, the intravenous injection of 5 c.c. of 10 per cent. calcium chlorid on three successive days. The coagulation time this morning is five minutes as compared with ten and one-half on admission. As usual we have a suitable blood donor available, but we have not deemed preoperative transfusion necessary.

While occasionally strictures occur without injury, most of the cases that I have seen have been the result of surgical accident. These result from improper placing of clamps as indicated in Fig. 122, or from blindly grasping with a hemostat in cases of cystic artery hemorrhage. No amount of reparative surgery is as satisfactory as a carefully performed primary operation. Finally let me emphasize the importance of isolating the cystic duct and ligating it under the eye.

Postoperative Note.—(Three months later.) The patient has made an uneventful recovery, and to date has no evidence of hepatic infection.

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CLINIC OF DRS. DAVID C. STRAUS AND I. HARRISON TUMPEER

MICHAEL REESE HOSPITAL

SUBCUTANEOUS TRAUMATIC RUPTURE OF THE SPLEEN WITH REPORT OF A CASE*

WHENEVER a physician sees a patient who has sustained a direct forceful injury to the abdomen, such as that caused by a fall from a height, a kick by a horse, being stepped on, struck by a heavy stone, being run over, crushed between two automobiles, and the like, he must always consider and look for evidence of rupture of one or more abdominal organs.

ETIOLOGY

Tabulation of cases reported in the literature (Bailey, Connors) and our case.

Subcutaneous Traumatic Rupture of Spleen.		
Street accident—struck or run over by vehicle		36
Falls: from a height	11	
Falls: over handlebars of bicycle	2	
Falls: on a projecting object, *e. g.*, corner of table	7	20
"Buffer" accident (compression)		3
Kick in abdomen		3
Physical assault		1
Struck by falling body of another person		1
Total		64

It is important to bear in mind that rupture of the liver is more common than ruptures of any of the other abdominal organs, that it is more frequent than rupture of the spleen and kidney added together, but that these are the next in order of frequency. A glance at the percentage of frequency in 494 cases of rupture of internal organs compiled by Geil is of interest.

* Read before the Chicago Surgical Society, February 1, 1929.

494 Cases (Geil)

Liver	59.9
Lungs	42.3
Spleen	33.0
Kidney	21.5
Heart	18.2
Intestine	11.1
Stomach	7.1
Bladder	4.4
Pancreas	4.4

From this table it is seen that of all the intra-abdominal viscera, the liver, spleen, and intestines are the organs most frequently ruptured.

Similarly, the statistics of Edler show that in rupture of the parenchymatous abdominal organs, rupture of the spleen occupies a prominent place. In 359 cases there was rupture of the liver in 183, kidney in 90, spleen in 83, and pancreas in 3.

In cases of rupture of the spleen there is very often simultaneous injury to other intra- and extra-abdominal organs. In 106 complicated cases Berger found injury to the liver in 48 cases, the left kidney in 32 cases, both kidneys in 30 cases, the stomach in 12 cases, the intestine in 7 cases, the pancreas in 6 cases, the thoracic organs and diaphragm in 27 cases, and the brain in 18 cases. The injury to the spleen is very frequently associated with fracture of one or more ribs, less often fracture of other bones, oftenest those of the left arm.

Injury to the kidney can practically be ruled out if examination of the urine, passed or obtained by catheterization, if this is necessary, fails to show the presence of blood and if, in addition, there is no spasm of the lumbar muscles and no evidence of a lumbar hematoma.

It is very rare, indeed, that one can make a positive preoperative diagnosis of subcutaneous rupture of the spleen. This is particularly true in the severe cases which demand immediate operation. However, in cases with serious intra-abdominal injury, it is not important to know which of the organs is damaged, but merely that some intra-abdominal organ is injured, for this gives the indication for operation. The chief value of recognizing which

organ is injured is in determining the site of the incision. The chief symptoms of value in determining that some intra-abdominal organ has been injured, and that, therefore, operation is demanded, are severe pain, particularly if this is increasing in amount, repeated vomiting, particularly if this is increasing in frequency, marked tenderness on pressure, and most important, but not necessarily present (as in the case we are reporting), rigidity of the abdominal wall.

When, in addition to these findings, there are signs of internal hemorrhage, with pallor, dulness in the left flank, and a rapid pulse, low in tension, the possibility of rupture of the spleen is strongly suggested. In the case we are about to report, one of the outstanding points of interest is that there was no dulness in the flanks, and the pulse-rate was only 80 and the quality was good.

As is the case with all injuries, rupture of the spleen occurs more frequently in males than females, and most commonly between the ages of twenty and forty.

Whereas subcutaneous rupture of the spleen is almost always the result of direct blows to the left side of the body in the region of the spleen, or falling from a height and landing on the left side, it may in some few cases, result from blows to the right side of the abdomen, and even rarely result from a fall when the victim lands on his feet, his buttocks, or even his head.

Subcutaneous rupture of a normal spleen is much less likely than when the spleen is enlarged due to disease. In the normal spleen, rupture is more likely when the organ is congested as during digestion and during pregnancy, for when congested the spleen is more friable. Subcutaneous rupture is particularly likely to occur in a spleen enlarged due to disease, such as malaria, kala-azar, isolated miliary tuberculosis, syphilis, typhoid fever, either during the disease or the resultant enlargement; fatty degeneration, particularly seen in chronic alcoholics; Banti's disease, hemophilia, splenomegaly due to cirrhosis of the liver, and leukemia. Lewerenz reports 82 malarial spleens in 135 cases of rupture.

The type of injury to the spleen determines to some degree

the type of surgical treatment that is indicated. The following types of injury may be encountered (Henschen):

(*a*) **Central Contusion Ruptures.**—These may result in traumatic splenomegaly, the formation of encapsulated hematomas, secondary rupture of an encapsulated hematoma into the peritoneal cavity with serious late intraperitoneal hemorrhage. In these cases, sometimes known as two-stage ruptures of the spleen, the symptoms are usually mild after the initial pain of the contusion and the original shock have been recovered from, until the subcapsular hematoma breaks through the capsule. Then, suddenly, the patient is seized with severe abdominal pain, collapses rapidly, becomes anemic, vomits, and develops marked abdominal rigidity. Such a picture may not develop until hours have elapsed, or may not occur until as late as even one or two weeks after the original injury, when the patient may be up and about, or may even have returned to his work.

(*b*) **Peripheral Subcapsular Tangential Contusions Due to Scraping.**—These result in the formation of subcapsular hematomas and blood cysts, which later may suppurate. The hematoma forms beneath the resistant capsule, which may be loosened in one or more places. When the hematoma increases in extent, enlarges, and exerts more and more pressure on the capsule, the capsule is likely to rupture and be further stripped off.

(*c*) **Isolated Tears of the Capsule.**—The ruptures séche of Catteloup.

(*d*) **Tears Involving the Capsule and the Parenchyma.**—Superficial, incomplete, or through the entire thickness of the organ.

(*e*) **Isolated tearing away of one pole.**

(*f*) **Incomplete or complete tearing away at the hilus.**

(*g*) **Isolated tearing of the splenic vein or artery or both vessels, or associated with parenchymatous injury.**

The recognition of "rupture in two stages" is so important that it deserves further mention. The secondary bleeding may be due not only to subcapsular hematomas, but also to secondary rupture of central hematomas; late rupture of a perisplenic hem-

atoma, which was primarily walled off by adhesions, and late bleeding from loosening up of clots or omental adhesions after these have primarily caused the first hemorrhage to cease, due to a secondary trauma or subsequent torsion of the spleen. The clinical symptoms which characterize these "ruptures in two stages" have been described above. It is important to bear in mind this group of cases.

The form and the extent of the tears, as indicated above, may vary greatly in different cases. When caused by severe injury the spleen may be split in several pieces, held together merely by small bridges of parenchyma, or they may be entirely separate from one another. Pieces may be carried away by the hemorrhage and at operation be found lying in blood or clots scattered in the peritoneal cavity. In the case of less severe traumas, tears occur which penetrate the parenchyma to varying depths. These are more often transverse than longitudinal, and more often lie on the hilus side than on the rounded outer convexity. It is usual to find more than one tear, and, occasionally, tears radiating from one point are encountered.

The escaped blood lies free in the peritoneal cavity. It at first collects in the region about the spleen, between the cupola of the left half of the diaphragm, and the colon. Here it usually forms a large collection and then tends to spread over the entire abdominal cavity, It is, as a rule, only later that it collects in the true pelvis and both flanks, but more especially the left. The rapidity of the bleeding varies greatly in different cases depending, though not always, on the nature and extent of the damage to the spleen. In some cases the hemorrhage is so severe that death ensues in a few minutes. In other cases the bleeding is very slow but persistent, until after hours or days death results from hemorrhage. It not uncommonly happens that the bleeding may cease, only to begin again after a few days, and then end fatally. This temporary cessation of the bleeding is usually due to the fall in blood-pressure associated with the initial shock. When the blood-pressure rises again the soft thrombi loosen and bleeding again begins, especially following

mechanical dislodgment, even from such slight causes as moving the body, coughing, and the like.

It is very rare that spontaneous healing occurs. Cases have been reported in which encapsulated, localized collections of blood, demonstrable by percussion in the region of the spleen, have later become absorbed. Furthermore, several cases have been reported in which individuals who have sustained a severe injury to the abdomen, and have later died from some other cause, at postmortem showed healed tears in the spleen. However, as Berger has pointed out, 92.7 per cent. of cases unoperated on, die, and 90 per cent. of these patients die from hemorrhage. For this reason, and also because of the danger of associated severe injury to other organs, immediate and systematic operation is demanded.

Symptoms.—The clinical symptoms are those of injury to an intraperitoneal organ or of internal hemorrhage. *However it must always be borne in mind that the pulse may be normal* (as in our case) *even in the presence of a severe hemorrhage.*

At the outset there is usually marked *shock*. In some cases there is an interval free from symptoms and there is absolutely no shock. The initial shock is sometimes recovered from only to reappear later as part of the picture of hemorrhage. *Abdominal pain* is practically always present, is chiefly localized to the left side of the abdomen, is aggravated by all movements, progressively increases in severity and, later, extends over the entire abdomen. It not infrequently is referred by way of the splanchnic fibers to the left shoulder, the left arm, and the left leg. *Vomiting* is present as a rule, but may be entirely absent. *Abdominal rigidity* is marked, as a rule, and there is *marked tenderness on pressure*. In the case we are reporting there was entire absence of any rigidity or even any increase in resistance on palpation, the abdomen being soft. There is ordinarily *dulness on percussion* radiating from the spleen, and this gradually increases in extent. Later, the *symptoms of hemorrhage* predominate the picture, the *pallor* of the face increases, the pulse becomes more rapid and weaker, and unless operation is under-

taken the patient dies from hemorrhage. These are the classical and well-known symptoms.

Henschen has recently pointed out some of the less well-known findings. These include: The *leukocytosis* of hemorrhage; an accompanying *hematuria* in 12 per cent. of the cases due to associated contusion or rupture of the kidney; *decrease in urinary excretion* due to decreased blood-pressure in the kidney; *absence of all peristaltic sounds; transmission of the heart-tones and breath-sounds to the left hypochondrium; a roentgenologically demonstrable "blood-shadow"* in the left hypochondrium, which shows respiratory mobility. He also calls attention to the fact that the diaphragm may be ruptured and the torn spleen may be herniated into the pleural cavity.

SYMPTOMS

(Résumé)

Those of injury to an intraperitoneal organ or of hemorrhage.

Absence of external bruises the rule.

Shock.—Usually marked at outset—sometimes absent. Sometimes recovered from, to reappear due to hemorrhage.

Abdominal Pain.—Practically always present. Chiefly localized to left of abdomen—later all over abdomen.

Vomiting.—Present as a rule.

Abdominal Rigidity.—Marked, as a rule.

Tenderness on Pressure.—Marked, as a rule.

Dulness on Percussion.—Radiating from spleen—gradually increasing in extent. When present in left flank is a symptom of importance.

Symptoms of hemorrhage later predominate the picture, especially pallor, rapid weak pulse, leukocytosis.

Death in 92.7 per cent. of cases not operated on (due to hemorrhage in 90 per cent.) may occur even after two or three weeks, suddenly, due to rupture of subcapsular hematoma.

F. Wilson, 1927, reported 2 cases dying without definite abdominal signs—one three days, the other nine days after accident.

The differential diagnosis from internal hemorrhage from other causes and from beginning peritonitis from rupture of the stomach or intestine is difficult and often impossible. The determining finding, pointing to intraperitoneal hemorrhage, is evidence of the presence of a rapidly increasing amount of fluid. But the value of this symptom is limited, due to the fact that collections of less than a quart are not demonstrable when the

patient lies on his back. The demonstration of air free in the peritoneal cavity of course, speaks for rupture of the stomach or intestine.

Treatment.—As soon as rupture of the spleen is suspected and probable, operation should be undertaken without delay. It is rarely advisable to wait for the initial shock to subside, for when the patient reaches the surgeon the shock from which the patient is suffering is usually not the initial shock, but that due to hemorrhage or beginning peritonitis. Delay usually means time lost. Preparation for immediate operation should be made, and arrangements made for subcutaneous saline infusion and blood transfusion. Ethylene is probably the anesthetic of choice, though some operators believe it is of definite value to use a positive pressure ether machine, particularly in patients suffering from hemorrhage, as this combats the dyspnea, and aids the failing pulse (Lombard, Jehn, Sauerbruch).

In all doubtful cases, and most of them are, it is best to open the abdomen through a midline incision above the umbilicus. If the spleen is found to be ruptured it is advisable, as a rule, to add a transverse incision from about the center of the vertical one, cutting through the left rectus muscle. As soon as the abdomen has been opened through the midline incision, and the bleeding is not found to be coming from the spleen, the liver should be inspected as it is the most commonly injured parenchymatous organ. If the liver is the organ that is ruptured the transverse incision can be made to the right. If both organs are ruptured, adequate room can usually be obtained when the tranverse incision is made to the left.

The spleen is rapidly drawn into the incision or toward it, the blood contained in it is gently squeezed back into the circulation, and the hilus is temporarily clamped either with the fingers or with a soft, rubber-covered clamp.

Henschen and some other surgeons believe that as soon as this is accomplished, the stomach, gall-bladder, and intestines should be rapidly inspected for possible rupture and this, if present, repaired. In case none of these hollow organs, which have infectious contents, are ruptured, Henschen believes it is

most advisable to aspirate the liquid blood that lies free in the peritoneal cavity, test a sample under the microscope to be sure that the red cells still retain their shape and color and, then, after filtering the blood through several layers of gauze, to inject it into a vein, unaltered, or diluted with Ringer's solution or salt solution, in amounts up to 1000 or 1500 cm., injecting it slowly. If this reinfusion is performed no transfusion from the donor should be done.

Büttner very recently, 1928, has called attention to the great dangers of reinfusion, and has collected reports of many deaths from its use. Blood transfusion is preferable.

The spleen should be saved whenever possible. Nevertheless, *splenectomy is ordinarily indicated.* But before deciding on this, conservative measures should be considered, and if likely to be successful, should be tried. There is probably no question that many spleens have been sacrificed which properly could have been saved.

Splenorrhaphy.—Certain surgeons argue strongly for suture of the spleen—splenorrhaphy—and base their arguments on the physiologic function of the spleen, and on the fact that certain changes have been noted following splenectomy. These, however, are not constantly present, are very variable, and there is no evidence of such adverse influence on health or longevity as to contraindicate splenectomy for traumatic rupture, which is ordinarily the operation of choice. Even in the case of young boys, as in the case we are reporting, normal growth and development has not in any way been interfered with by splenectomy. Some of these cases, it is true, may show a definite and stubborn anemia which requires prolonged treatment. In others the blood gradually returns to normal in one to three months. Others, on the other hand, may show polycythemia, with hemoglobin values correspondingly higher than normal. Some cases show a decreased resistance to infections, some show normal resistance, while still others show increased resistance.

Th. Papayoannou, at the recent International Congress of Surgery at Rome, properly evaluated the question of splenorrhaphy in traumatic ruptures of the spleen. He pointed out that

the technic of this procedure is delicate because of the peculiar friability of the organ; that unfortunately this operation has *only limited indications*, such as in the case of *superficial ruptures principally involving the upper surface of the spleen*, for it has been shown that *it is not practical to use splenorrhaphy in tears, of the lower surface of the spleen*, and that in every case, splenorrhaphy is a difficult operation from the standpoint of technic, and that it does not always give assurance of perfect hemostasis. He considers certain of his own cases characteristic in which there existed severe contusions in addition to the fissures; that only cases presenting simple fissure permit the employment of splenorrhaphy; that cases presenting severe contusion demand splenectomy. On the other hand, he further points out that *in order to completely explore the spleen* and *to be assured that no unobserved ruptures exist*, it is necessary to draw down the organ completely in the operative field, to examine it thoroughly, and to facilitate suturing. In order to do this *it is necessary to divide the gastrosplenic and phrenicosplenic ligaments*, and *this allows the spleen to become mobile, with all the dangers of torsion, including necrosis*. For these reasons in the greater number of cases where there are deep and multiple ruptures of the spleen, it is best to use the most rapid and safe procedure, which is splenectomy. Patel, at the same Congress, was of similar opinion. He points out that it is undoubtedly of advantage to save the organ, but that *the indications for splenorrhaphy remain limited*. Henschen, at the same Congress, stated emphatically that every effort should be made to save the spleen; that suture of tears should be attempted, bleeding vessels ligated, and attempts made to try the efficacy of suturing in free transplants of muscle, fat, omentum, or pieces of fascia. If, however, splenectomy is unavoidable he advocates leaving behind the largest possible portions of the spleen that have good arterial blood-supply and are clearly capable of being covered with a capsule and capable of regeneration. If the entire spleen is removed the possibility exists of reimplanting the partially or completely decapsulated organ, into a sac of peritoneum or into a retro- or pro-peritoneal pocket, made by loosening up the peritoneum. He does not make

it clear, however, whether this advice is based on actual clinical experience gained in cases of ruptured spleen, or merely on theoretic grounds and animal experiments. He does not submit or refer to any cases in which he has carried out either procedure.

All surgeons agree that *splenorrhaphy has a rather limited field, as compared with splenectomy.*

Tamponade.—The insertion of packing into the tears, *i. e.* tamponade, is rarely justifiable; when it is removed, bleeding is apt to recur; it is *prone to be followed by infection and secondary hemorrhage*, and it is prone to cause undesirable adhesions, even resulting in ileus, and *should only be considered as an exceptional method.* Patel, referred to above, at the recent Congress, properly evaluated the procedures when he stated that in spite of its ease, and the undeniable successes which have followed its use, *tamponade is truly an insufficient and hazardous method* of treating ruptures of the spleen, and *its use should be limited to slight ruptures in patients whose general condition* does not permit procedures that are more time consuming.

TREATMENT
(Résumé)

Immediate Operation.—Rarely advisable to wait for shock to subside. Delay usually means time lost.

Ethylene Anesthesia.—Subcutaneous saline infusion as soon as bleeding is controlled.

Midline incision above umbilicus, with transverse incision to left, parallel to intercostal nerves, through rectus muscle.

1. *Splenorrhaphy.*—Suture of spleen.
   Indications limited to superficial ruptures involving only upper surface of spleen. Not practical in tears of lower surface. In order to completely explore spleen, *i. e.*, lower surface, necessary to divide gastrosplenic and phrenicosplenic ligaments, rendering spleen mobile, with danger of torsion, including necrosis.
2. *Tamponade.*—Insertion of packing into tears rarely justified.
   Hazardous. Prone to be followed by:
   1. Bleeding when packing is removed.
   2. Infection and secondary hemorrhage.

   Should be limited to slight ruptures in patients whose general condition is poor.
3. *Splenectomy.*—Usually indicated. The operation of choice. A slight anemia, persisting for years, with a slight leukocytosis, usually follows splenectomy, but does not adversely affect growth or health and does not lessen individual's resistance to infection, as a rule. Resistance usually normal, sometimes increased.

Results.—J. Quénu has recently tabulated a series of 353 traumatic ruptures of the spleen, dividing them in two periods: 1885–1912 and 1912–1925:

1885–1912	Splenectomy	179	63 deaths	35.19
	Tamponade	19	2 "	10.52
	Splenorrhaphy	5	2 "	40.00
	Total	203	67 "	33.00
1912–1925	Splenectomy	135	32 deaths	23.70
	Tamponade	12	3 "	25.00
	Splenorrhaphy	3	1 "	33.33
	Total	150	36 "	21.74

CASE REPORT

The patient, a boy nine years of age, had been a patient of Dr. Tumpeer for many months, because of attacks of pain in the abdomen which came on intermittently. Examination had never shown any gross anomalies or positive findings, and the boy was otherwise a healthy normal child.

On April 4, 1928 Dr. Tumpeer was called on by telephone to come and see the boy, being told that the child had fallen from the porch railing about 5 feet high, had landed flat on his abdomen on the ground, and that since that time, which was shortly after lunch, he had almost continual abdominal pain, localized chiefly about the umbilicus, and that this was increasing in severity, accompanied by nausea and vomiting. The vomiting had been increasing in frequency and contained minute flecks of blood, but not more blood than might be expected from the retching. Dr. Tumpeer advised the mother to bring the child into the Michael Reese Hospital without delay, which was done, and he was admitted to the hospital at 6.30 P. M. (J. C. Michael Reese Hospital Admission No. A-97085). At 6.30 P. M. temperature was 99.6° F., pulse 80, respirations 20.

Dr. J. Glaser, who saw the boy before Dr. Tumpeer reached the hospital, recorded the following findings, and diagnoses: The urine passed is grossly clear. The vomitus contains a few minute flecks of blood stained mucus, not more than could be expected from the retching. Essential physical findings:

Sensorium clear. Child pale, lips somewhat dry. Pulse full, regular, 80, does not suggest an internal hemorrhage. Pupils regular, equal, react to light; extra-ocular movements are normal. No hemorrhage from ears, nose, or mouth. Ear-drums appear normal.

Lungs resonant throughout; no râles. Heart tones good.

Abdomen scaphoid; moves freely with respiration, no rigidity. Tense cord-like mass felt in left iliac fossa, probably the sigmoid. Marked tenderness to pressure all over abdomen, especially in left upper quadrant. Boy points to just above umbilicus as the site of pain, which he says is constant (*i. e.*, not coming and going as peristaltic pain). No evidence of recent skeletal injury. No Kernig or Brudzinski or Babinski. Knee-jerks not elicited. Ankle-jerks very slight, but equal. No ankle-clonus.

Impression: 1. Solar plexus shock. 2. Retroperitoneal hemorrhage with hematoma. 3. Retroperitoneal rupture of a viscus—duodenum.

Dr. Tumpeer did not reach the hospital till a little later, and 7.30 P. M. recorded his findings, in addition to confirming the findings of Dr. Glaser. Dr. Tumpeer's notes: "Yellow pallor; doubled-up position; intermittent abdominal pain with vomiting; umbilical pain; generalized abdominal tenderness; no evidence of fluid in abdomen; contracted sigmoid palpated; no evidence of injury; no cranial signs; pulse good."

Meanwhile, the *urine* passed on admission had been examined and showed color, amber; specific gravity 1.030, reaction acid, albumin absent, sugar absent, acetone absent. Microscopic: few white blood-cells. *Blood examination* showed: hemoglobin 80 per cent.; red blood-count, 4,280,000; white blood-count, 13,400. Blood-pressure, 108/64.

Dr. David C. Straus was called in consultation and examined the child immediately after Dr. Tumpeer had finished his examination. Dr. Straus recorded his findings and diagnosis at 8.15 P. M. as follows:

"Child appears restless, with abdominal pain of crampy nature, localized about region of umbilicus. Boy is nauseated and has vomited repeatedly.

Head—no evidence of skull injury. Scalp and skull intact. Eyes normal. Throat not injected; no cerebrospinal fluid. No bleeding from ears. Tongue protruded normally. *Neck* enlarged, bean sized, left cervical adenopathy, otherwise negative.

Chest—no abnormal findings. Lungs—no abnormal findings. Expansion good and equal. No evidence of free fluid (blood).

Abdomen—no rigidity, no masses felt. Tenderness rather general; no more in one place than in another. No evidence of free fluid. Both flanks show normal tympany, also when child is rolled on right and left sides.

No tenderness or rigidity in either loin. No hematoma in lumbar region or loins. No tenderness or rigidity of spine. No evidence of spinal injury.

In view of the history of falling 5 feet and landing on his abdomen, with pain now for five hours, increasing in severity, with nausea and vomiting, increasing in frequency, I believe exploration of abdomen is indicated, even though there are no positive pathologic findings on physical examination, except tenderness. Urine is free from blood; pulse is slow and of good quality.

Preoperative Diagnosis.—Exploratory laparotomy for possible damage to bowel, liver, or spleen."

Immediate operation was arranged for and the boy was given a hypodermic injection of morphin sulphate gr. $\frac{1}{12}$, with atropin sulphate gr. $\frac{1}{150}$ at 8.30 P. M., and brought to the operating room. The child was anesthetized with ethylene and operation begun at 9 P. M.

Operation.—As the preoperative diagnosis was "possible injury to intestines, liver, or spleen" (but it was impossible to determine before opening the abdomen which organ was ruptured), the abdomen was opened by a midline incision above the umbilicus. As soon as the peritoneal cavity was opened, free blood escaped in large amount, and the median incision was continued downward below the umbilicus, continuing it downward to the left of the umbilicus.

The left side of the abdomen seemed to be the site of the bleeding and consequently exploration began here. Free blood and clots were removed from the left lower quadrant and it was ob-

served that the bleeding was coming from higher up. The descending colon and its attachments were rapidly but systematically examined, and no damage found. Next, the spleen was palpated, but no gross tears could be felt. However, it was logic to expect that the spleen was the damaged organ, especially as brisk bleeding came from its neighborhood, and in order to reach the spleen easily, a second incision was made, a horizontal one, beginning at the middle of the vertical incision, cutting through the left rectus muscle, and carrying the incision parallel to the intercostal nerves, to the left as far as the anterior axillary line (Fig. 125).

In order to prevent retraction of the rectus muscle in its sheath, one mattress suture of No. 2 chromic catgut was used to suture the two cut portions to the sheath near the site of division.

The large flap of abdominal wall to the left was now strongly retracted upward and to the left, and this gave excellent exposure of the spleen, as well as of the entire left half of the diaphragm. The pedicle of the spleen was now rapidly grasped between the index and middle fingers of the left hand, and the spleen was drawn toward the incision. Two transverse tears were seen on the upper rounded surface, at about the junction of the upper with middle third of the organ and these tears were bleeding actively. There was also a longitudinal tear which extended through the capsule, but practically did not penetrate into the parenchyma, and this long tear, which obviously had been caused by the adjacent rib, was not bleeding to speak of.

Reinfusion of the blood in the peritoneal cavity was thought of, but it seemed unwise to delay for this procedure, as subcutaneous saline infusion had been begun as soon as the spleen had been found to be the site of the hemorrhage, and the hemorrhage had been controlled by compressing the pedicle. It seemed wiser to do a blood transfusion after completion of the operation, if it then seemed indicated, and to get the patient off the operating table as rapidly as possible. Consequently, the blood was typed, but no reinfusion done. It seemed illogic to clamp the pedicle of the spleen as suggested by Henschen, and leave the

organ with its blood-supply shut off, while a systematic examination was carried on of the stomach, gall-bladder, and entire small and large intestine. The procedure of reinfusion was not seriously considered. However, the subcutaneous infusion was continued during the remainder of the operation.

Splenorrhaphy was seriously considered and attempted. Having brought the spleen down into the incision one suture of No. 2 plain catgut was passed across the larger and deeper of the two transverse tears and tied, but it failed to control the bleeding. Also, a large subcapsular hematoma was seen to be forming and increasing in size. Consequently, it was obvious that the tear was deep in the parenchyma, was extensive, and splenectomy seemed indicated. It was now performed, great care being taken in dividing the gastrosplenic ligament not to injure the adjacent stomach. The vasa brevia were grasped and ligated, and the stomach was not injured. When the spleen was freed except for its pedicle, this was doubly ligated with two No. 2 chromic catgut ligatures placed close beside one another and now all bleeding was controlled and the field showed no more bleeding vessels, the ligaments having all been clamped before diving them. These were now all ligated by transfixion, using No. 2 chromic catgut.

When the spleen was now examined, after it had been removed, another tear was seen which was not discovered when the organ was still in the abdomen. This tear was a longitudinal one, on the under surface of the organ, quite near the hilus. It is additional evidence of the fact pointed out by Patel, that the spleen has to be so freed, by cutting all its retaining ligaments before one can be sure not to overlook a tear, that it is attached by its vascular pedicle only, and thus there is later the great risk of torsion and necrosis, from this torsion. *Had splenorrhaphy been done in this patient, without having cut all the ligaments,* which is necessary before one can expose this portion of the spleen, *this tear would have been missed, and the patient would in all probability have bled from this unnoticed tear.*

Having removed the spleen and examined the stomach, which showed no gross injury, and being sure that there was no more

bleeding from the left half of the abdomen, the liver was next examined for possible injury, but none was found. The gall-bladder was carefully examined, but found intact. The child's pulse by this time was becoming more rapid, and as is ordinarily done, this examination was made hastily, but no evidence of rupture discovered. There were noted, however, small hematomas at several places, in the mesentery as well as in the omentum.

As the child had been under Dr. Tumpeer's care previously for intestinal symptoms in the nature of intestinal colics, the region of the umbilicus was quickly examined for the possible presence of vestigial remains, and the appendix was examined as well as the terminal portion of the ileum, for a possible Meckel's diverticulum. The appendix was unusually long for a child of nine years, and it was definitely kinked. The patient's condition did not warrant appendectomy at this time, but it seemed indicated without question, some time later. No other pathology was found.

Having mopped out all free blood and removed all clots, the abdomen was closed without drainage, using No. 2 chromic catgut for the peritoneum and posterior rectus sheath together, and for the fascia in the median line. The divided rectus muscle was carefully sutured, using the same suture material, and then the anterior rectus sheath was closed with No. 2 chromic catgut. Then several tension sutures of No. 8 black waxed silk were placed, but not tied, until the skin had been closed with a running black waxed silk suture. The boy left the operating room in very fair condition, with a pulse of 160, but of good quality.

Postoperative Course.—The postoperative course was uneventful except for two facts: Bile-stained vomitus containing blood twice on April 6th, the second postoperative day, and some serosanguinous and later seropurulent discharge from the middle portion of the transverse incision for a few days, apparently a chromic catgut reaction, where so much had been used to make a tight closure of the left rectus muscle and its sheaths. Otherwise closure was by first intention, *i. e.*, primary union.

The pulse, which was 160 when the boy was returned to bed

after the operation, fell to 146 by midnight, and was down to 132 by the end of twenty-four hours, was 120 at the end of forty-eight hours, and to 88 at the end of seventy-two hours.

The postoperative treatment was essentially that of any

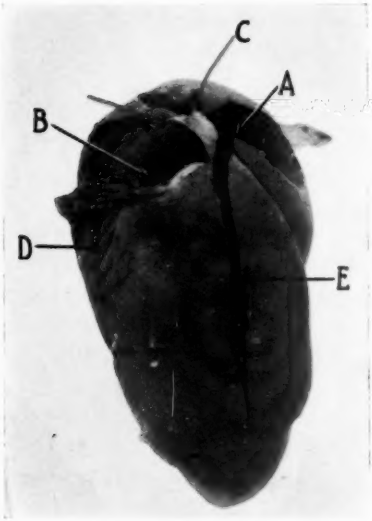

Fig. 123.—Photograph of spleen, normal size, outer convex surface, showing: *A*, Transverse rupture first observed and suture attempted (*C*); *B*, transverse rupture observed when suture (*C*) was being inserted; *D*, subcapsular hematoma; *E*, capsular rupture.

Fig. 124.—Photograph of spleen, normal size, medial surface, showing (*A*) longitudinal rupture near upper pole of renal surface of spleen. This rupture was not detected and could not be seen until the spleen was removed. A tear here cannot be seen until after all the ligaments have been cut, and it is for this reason that splenorrhaphy is not a safe procedure.

laparotomy. Blood transfusion had beeen arranged for, but never seemed indicated and was, therefore, not done.

On return to bed the boy was given a hypodermic injection of camphor in oil, 15 minims. His pulse at this time was rapid, 160, but of good quality. Retention enemata were given once

at 11 P. M., the night of the operation, also every four hours for the next two days. These consisted of glucose 5 per cent., sodium bicarbonate, 2 per cent., in tap water 4 ounces. At 12.30 A. M. he was given 600 cm. of normal saline solution as a subcutaneous infusion. Water by mouth was begun at 11.30

Fig. 125.—Photograph of patient before his discharge from the hospital on the twentieth day. This shows the median incision extending from below ensiform downward, going to the left of the umbilicus and ending a short distance below the umbilicus, and also the transverse incision from about the center of the median incision, extending laterally to the left, almost to the anterior axillary line, and parallel to the intercostal nerves, so as not to injure these.

P. M. the night of the operation, and was never discontinued thereafter. Normal saline subcutaneous infusions were given again at 8 A. M., 700 c.c., and at 8 P. M. the day following the operation, *i. e.*, April 5th, and 900 c.c. was given at 10 A. M. on the 6th.

No more subcutaneous or rectal administration of fluids was done after the morning of April 6th, and his recovery was rapid. He was allowed to walk on the fourteenth day, and by this time the wound was completely healed (Fig. 125). He was given ovoferrin at the end of a week, and then this was substituted by spleen marrow. He left the hospital at the end of twenty days, April 24, 1928.

The blood examinations are of especial interest.

On admission, at 6.30 P. M., April 4, 1928, hemoglobin was 80 per cent., the red blood-count 4,280,000, white blood-count 13,400, and the blood-pressure 108/64.

The postoperative blood examinations were:

Date.	Hg.	Red count.	W. B. C.	N.	S. M.	L. M.	T.	E.	B.	U.	Remarks.
1928											
4/5	70	3,600,000	14,300								Blood in vomitus.
4/6	65	3,220,000	14,600								
9 A. M.											
4/6			22,000								Blood in vomitus.
5 P. M.											
4/7	60	3,260,000	18,000								
4/8	60	3,280,000	13,100								
4/9	60	3,270,000	13,500	Blood platelets 600 000							
4/12	60	3,480,000	11,700	62	20	12	6				
4/13	65	3,500,000	12,300								
4/14	65	3,440,000	13,000								
4/15	65	3,700,000	13,300	53	36	4	3	2	1	1	Myelocytes 2.
4/16	70	3,648,000	12,600	59	28	5	3				Cells show moderate achromia, occasional basophilia, slight anisocytosis, microcytes present.
4/17	70	3,660,000	12,100								Fragility of red cells normal.
4/21	70	3,900,000	8,800								
4/24	70	3,880,000	10,000	49	45	4	2				
1929											
1/28	65	3,610,000	15,200	68	25	3	4				

Conclusions.—In closing we wish to point out that this case we are reporting is particularly instructive in that it shows:

1. A spleen may be ruptured for as long as five hours and at operation show active hemorrhage, and yet immediately before operation show *a pulse of only 80 and of normal quality* (a fact that has been noted before).

2. The only findings indicating the serious nature of the case may be merely:

(*a*) Pain about the umbilicus, increasing in severity.

(*b*) Vomiting, increasing in frequency.

(*c*) Tenderness on pressure all over the abdomen, perhaps slightly more marked on the left side, and

(*d*) Pallor.

3. The symptom which is most constant in most cases of rupture of the spleen—that is, *abdominal rigidity—may be entirely absent.*

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4/9	60	3,270,000	13,500	Blood platelets 600 000									
4/12	60	3,480,000	11,700	62	20		12		6				
4/13	65	3,500,000	12,300										
4/14	65	3,440,000	13,000										
4/15	65	3,700,000	13,300	53	36		4		3	2	1	1	Myelocytes 2.
4/16	70	3,648,000	12,600	59	28		5		3				Cells show moderate achromia, occasional basophilia, slight anisocytosis, microcytes present.
4/17	70	3,660,000	12,100										Fragility of red cells normal.
4/21	70	3,900,000	8,800										
4/24	70	3,880,000	10,000	49	45		4		2				
1929													
1/28	65	3,610,000	15,200	68	25		3		4				

Conclusions.—In closing we wish to point out that this case we are reporting is particularly instructive in that it shows:

1. A spleen may be ruptured for as long as five hours and at operation show active hemorrhage, and yet immediately before operation show *a pulse of only 80 and of normal quality* (a fact that has been noted before).

2. The only findings indicating the serious nature of the case may be merely:

(*a*) Pain about the umbilicus, increasing in severity.

(*b*) Vomiting, increasing in frequency.

(*c*) Tenderness on pressure all over the abdomen, perhaps slightly more marked on the left side, and

(*d*) Pallor.

3. The symptom which is most constant in most cases of rupture of the spleen—that is, *abdominal rigidity—may be entirely absent.*

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CLINIC OF DR. ALBERT H. MONTGOMERY

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PSEUDO-APPENDICITIS IN CHILDREN

OF late years much has been written about the importance of making a diagnosis of appendicitis when it is the cause of abdominal pain in children. We must continue to emphasize this point for only by an early diagnosis can we hope to reduce the mortality in childhood. The deficient ability of the abdomen to localize the infection permits general peritonitis to set in earlier than is usual in adults. However, it is often difficult to satisfactorily elicit two of the most prominent signs of this disease, *i. e.*, localized tenderness and rigidity. When these signs are not prominent, many other conditions may give abdominal pain in children and greatly simulate appendicitis as may be seen in the following cases which I wish to discuss:

Case I.—A white boy five years of age was brought to the Children's Memorial Hospital October 20, 1928. He had been sick for four days with fever, vomiting, pain in right side of the abdomen, and difficulty in breathing. His trouble began with fever which soon ranged to 103° F., and remained so. Vomiting began at the same time, and occurred after every meal. For the past two days he had had marked difficulty in breathing and pain of moderate degree in the right side of the abdomen.

When examined the child appeared to be acutely ill with marked respiratory difficulty and an expiratory grunt. Bronchial breathing, dulness, and bronchophony were found over the right lower lobe. There was rigidity of the right abdominal wall, especially marked on the right side. Some tenderness was present in a general way over the right lower quadrant. The temperature was 104° F., pulse 160, respiration 48. Blood examination showed 5660 leukocytes, of which 83 per cent. were polynuclears.

Comment.—This child was very sick and apparently had a right lower lobe pneumonia. The abdominal rigidity, however, was so marked that with tenderness in the right lower quadrant the question of an appendicitis in association with the pneumonia was raised. Appendicitis rarely occurs either with or following pneumonia, but abdominal signs and symptoms in children are frequently found to be referred from some inflammation of the lung or pleura. I think this is especially true in conditions involving the pleura over the diaphragm and the expiratory grunt of this patient seemed to point to an involvement of the diaphragm. The high temperature, rapid pulse, and marked difficulty in breathing together with a very low leukocyte count, which in pneumonia indicates a very serious infection, made operation seem inadvisable. Even in the presence of an inflamed appendix it seemed better all around to await further developments. Subsequently, as the clinical picture progressed, the abdominal symptoms subsided, the pneumonia began to clear up, but in about a week, definite signs of empyema were present in the lower right chest cavity, and pus was found with the aspirating needle. This was treated by drainage, and the child went on to a complete recovery.

If this patient had been seen earlier, before physical signs in the chest had become pronounced, the abdominal signs might have easily led to a diagnosis of appendicitis. It should be emphasized that in all cases of suspected appendicitis in children a most careful and painstaking chest examination should be made in order to rule out this matter of referred pain. If there is any doubt about the question, an *x*-ray film of the chest will often reveal the shadows of an early pneumonia when the findings on physical examination are not very marked.

Another chest condition that is frequently overlooked is pericarditis with pain referred to the abdomen. The rapid pulse that goes with this cardiac condition is usually greater than we find in appendicitis and if auscultation is done carefully a friction rub may be heard with the heart-beat. Unfortunately, this sign has a tendency to come and go, and if it is absent at the time of the examination, the diagnosis of appendicitis is a mistake

that is difficult to avoid. One such case that I know of was operated on with no apparent ill effects.

Case II.—A white boy nine years of age was admitted to the Children's Memorial Hospital on October 9, 1928. His parents stated that he was taken sick five days before with pain in the right side of the abdomen, which was sufficient to keep him awake at night. The same day some black and blue, and some small red spots were noticed on his legs, and the boy complained of some pain in his knees and ankles. The day after onset the boy vomited twice and once the next day, but there has been no vomiting since. Fever was present from the onset of his trouble. The abdominal pain continued since the onset, but the pain in the knees and ankles subsided after the first day. The bowels were moved with cathartics the first three days of his illness, but at the time of admission they had not moved for twenty-four hours.

When examined, the child appeared to be moderately ill. The tonsils were of moderate size, but acutely reddened. The cervical and inguinal glands were enlarged and somewhat tender. The abdomen seemed to be somewhat resistant to palpation except in the upper left quadrant. Tenderness was generalized over most of the abdomen, but more marked on the right side. The legs showed petechiæ in the region of the ankles. The physical findings otherwise were negative. Temperature was 99° F., pulse 120, and respiration 24. The urine showed some crenated red cells and a positive chemical test for blood. An examination of the blood showed hemoglobin 75 per cent., red cells 6470, and white cells 25,760.

Comment.—On physical examination this patient seemed to have an acute appendicitis. However, the history of the onset with joint pains and petechial hemorrhages associated with abdominal pain seemed to point more toward a purpura. The finding of the blood in the urine seemed to substantiate this diagnosis. The child was placed under observation, Wassermann and von Pirquet tests were made, and a blood-culture was taken. All of these were negative. The abdominal pain disap-

peared in a few days, while at the same time petechial hemorrhages appeared in crops and the child subsequently showed a definite picture of purpura.

Case III.—A girl three years of age was admitted to the Children's Memorial Hospital, July 24, 1928. The child was taken sick the day previous with abdominal pain, fever, and chilly sensations. There was generalized pain over the abdomen and tenderness in the epigastrium. Urination had been more frequent than usual.

When examined, the child had flushed cheeks and the appearance of being acutely ill. The abdomen was tender, especially in the region of the epigastrium and around the umbilicus. There wasno distention, and it was impossible to be sure whether rigidity was present or not. The skin showed a few pustules over the buttocks, and occasional ones scattered over the rest of the body. The blood-count made showed 21,700 leukocytes, 86 per cent. of which were polynuclears. There were no other abnormalities. On admission her temperature was 104° F., pulse 140, respiration 55. Examination of the urine showed the presence of albumin and 50 white blood-cells in the low power field in an uncentrifuged specimen.

Comment.—The clinical picture presented by this patient is one of the most common that we find in acute abdominal conditions in children. The fact that the patient is a girl should make us think immediately of a possible pyelitis which is seen more commonly in girls than in boys. The temperature also is suggestive for appendicitis as a rule does not produce such a high temperature while a pyelitis frequently does. The inability to find any area of definite rigidity speaks against appendicitis. Finally, the presence of a large number of white cells in the uncentrifuged urine points definitely to an involvement of the urinary tract making the diagnosis of a pyelitis very definite. It should be said, however, in this connection that occasionally we find pus-cells in the urine of appendicitis patients when the involved tip of the appendix rests against, or is adherent to, the ureter which passes down behind the peritoneum in this region.

Frequently in such cases there is marked pain and tenderness along the abdominal wall posteriorly. In any case of doubt the appendix should be removed.

The patient whose history I have just given cleared up very satisfactorily under the usual medical treatment. She was cystoscoped later on, but no abnormalities were found.

Case IV.—A white boy twelve years old entered the hospital with a history of having been sick for one week with pain, vomiting, and diarrhea. On the fourth day of his illness he had pain in the right inguinal region which increased until the child refused to walk or extend the right leg. On physical examination the abdomen was found to be rigid, but it relaxed on gentle palpation except in the right lower quadrant. Abdominal tenderness was present on the right side from the level of the navel down to the hip. The leg was held slightly flexed and rigid, Just inside of Poupart's ligament, there seemed to be a definite fulness as though there was a mass present in that region. Motion of the hip-joint was very painful. Temperature was 103° F., pulse 110, respiration 25. A blood-count and culture were negative. The urine showed a trace of albumin; von Pirquet test was negative. *x*-Ray examination at this time showed no abnormalities.

A weight extension was applied to the right leg, and the foot of the bed elevated. Under this treatment the temperature came down to normal in ten days. An *x*-ray examination, two weeks after admission, showed an osteomyelitis of the acetabulum. The mass just above Poupart's ligament persisted, but did not appear to be very tender. I explored the mass on the inner side of the ilium, and found an abscess leading down to the acetabulum. The child is still under treatment.

Comment.—When the child was first examined the abdomen was tender and rigid in the right lower quadrant, very much like an appendicitis. The thigh was also held slightly flexed as these patients frequently do in order to relieve the muscle tension. However, the hip was so definitely fixed and so very painful that one could not escape the conclusion that the hip-joint

was involved in the pathologic process. The mass just above Poupart's ligament appeared to be attached to the inner side of the ilium and led us to feel there was probably an extension of the process through the acetabulum up along the inner side of the pelvis. Such a picture is not infrequently seen in osteomyelitis involving the head and neck of the femur where the bone abscess is found within the capsule of the hip-joint, and extends through the acetabulum to the inner side of the ilium. The abscess frequently points just above Poupart's ligament where it can be opened extraperitoneally. The history of this case illustrates the importance of looking for lesions of the hip-joint in all cases of pain and stiffness in the rght lower quadrant.

Somewhat related to this group of cases involving the hip-joint are the cases of early Pott's disease which have pain localized to the right side of the abdomen due to pressure on the spinal nerves. When associated with an abscess along the ilium the similarity to an appendicitis may be most marked. The correct diagnosis can be readily made as a rule if the spine is examined as a routine procedure in all cases of suspected appendicitis in children. Tenderness and rigidity of the spine should suggest the advisability of an *x*-ray film which will quickly settle the diagnosis. This examination of the hip and spine usually requires only a few minutes, but I have found that they are usually overlooked when examining children who complain of pain in the abdomen.

Case V.—A colored boy four years of age entered the hospital with a history of having been sick for eight days previous to admission. The trouble began with vomiting which occurred several times in the first twenty-four hours, and which the mother thought was due to eating candy and watermelon. Fever appeared on the second day, and became rather high on the following day, but the child did not stay in bed. There was some diarrhea about this time with foul stools. Cascara and castor oil were given, but the fever continued and the child began to complain of tenderness in the region of the navel and the right

side of the abdomen. Sensation of pain and tenderness in this region continued for six days. The history otherwise was negative.

Physical examination showed signs of rickets such as a bowing of the tibia and a rachitic rosary. The throat was slightly reddened and the cervical glands were palpable. The right side of the abdomen was quite tender and somewhat rigid. By careful palpation a definite mass could be felt extending from the kidney region down to the ileosacral region. It appeared to be more prominent posteriorly and felt somewhat like a kidney. Blood examination showed 12,600 white blood-cells. The Wassermann and von Pirquet tests were negative. Urine examination also was negative. *x*-Ray examination showed no enlargement of the kidney, and no stones were demonstrable. The mass somehow did not feel exactly like an enlarged kidney, and seemed to extend upward and posteriorly more than the usual appendiceal abscess. Temperature was 102° F., pulse 95, and respiration 23. The child was kept in bed and observed for a few days, and during this time his condition improved markedly, and the mass decreased in size daily until it finally disappeared. At the same time the white blood-count came down to normal.

Comment.—When first examined this patient appeared to be a case of appendiceal abscess, but the history was rather against that diagnosis, as a protracted period of vomiting and diarrhea lasting for several days is seldom seen in appendicitis. Also, as I have already mentioned, appendiceal masses are usually found well limited to the ileosacral fossa, and do not extend posteriorly and upward toward the kidney. The definite absence of urinary findings and a negative *x*-ray examination were against a lesion of the kidneys, such as a hydropyonephrosis, However, if the child had not improved, a cystoscopic examination would have been made. As the clinical picture cleared up completely without giving us any further definite findings, I feel that this was probably an acute inflammatory mass, most likely a retroperitoneal lymphadenitis. This condition is not uncommonly found in children and resembles appendicitis very strongly, especially when it involves the mesenteric glands. In such cases the diagnosis has been made at operation when the appendix was found

to be quite normal. The mesentery is filled with numerous enlarged lymph-glands each about the size of a hazel-nut. I know of no way to avoid a mistake in the diagnosis in such cases, and so I feel that we will continue to operate on many of these patients under the diagnosis of appendicitis, for in all cases of doubt that is the thing to do, especially as simple laparotomy does not seem to injure these patients in any way. The lymphadenitis is probably due to infection entering through the gastro-intestinal tract or possibly the air-passages.

Brennemann has called attention to the frequency of abdominal pain in association with throat infections in children. He thinks that many of these cases are due to the swallowing of infected sputum. As there is a gastro-enteritis very frequently associated with these throat infections, the bacteria are able to pass through the inflamed mucosa, and produce a mesenteric lymphadenitis. In some patients enlarged glands can be felt through the abdominal wall.

In this connection it should be remembered that some of the acute infectious diseases such as measles and scarlet fever, which have a prominent throat involvement, often show abdominal symptoms at the onset. A correct diagnosis can usually be made if the mouth and throat are carefully examined. However, it must be emphasized that a throat infection may be complicated by a definite appendiceal infection. In such cases the tenderness is usually more marked than the pain, and is present directly over the inflamed appendix. Rigidity, too, is usually very definite over the right lower quadrant.

CLINIC OF DR. C. B. HUGGINS

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CONSERVATISM IN GENITO-URINARY SURGERY

Case I. Great Improvement in Bladder Diverticula Following Relief of Obstruction.

Case II. Conservative Treatment of Rupture of the Bladder Following Interposition Operation for the Cure of Marked Pelvic Relaxation.

Case III. Hypernephroma Without Symptoms or Physical Signs.

THE 3 cases which I present here are interesting because of their rather unusual character, and because they illustrate the growing trend toward conservatism in genito-urinary surgery. Conservative urology is based upon well-understood and well-recognized observations of how both disease of the urinary tract and various forms of therapy benefit or disturb people. Radical surgery indicates a departure from known observations, and sound principle as generally accepted. All new departures in diagnosis and treatment are at first radical, and may remain so, but invariably become accepted as conservative thought if they present improvements on known methods. Conservatism does not mean non-operative treatment. It is as radical to treat prostatic obstruction with a moderate, or greater, amount of residual urine non-surgically as it is to treat acute appendicitis with morphin and the ice-bags. In deciding whether a procedure is conservative or radical we must consider, primarily, the end-result, and then the inevitable or likely morbidity and the average mortality. The final opinion is based of course on an evaluation of these factors.

CASE I.—GREAT IMPROVEMENT IN BLADDER DIVERTICULA FOLLOWING RELIEF OF OBSTRUCTION

This old man of seventy-eight years came to us a year ago complaining of pain in the suprapubic region of dull and aching character, brought on by fulness of the bladder and not entirely relieved by micturition. This type of pain was studied first by Henry Head, in 1894, who related this pain of overdistention to the spinal center in the first and second lumbar cord segments, corresponding skin areas often being sensitive to touch and thermal agents. This pain is aggravated by a full rectum. Coincidental with the suprapubic pain, appeared a frequency of urination and nocturia of six or eight times. He has also had pains in the arms and legs and feet which are relieved by exercise. This is often associated with the hypertrophic arthritis of old people. His past history was negative, except for two attacks of gonorrhea in the early twenties. Since then he has had five children. Particular attention was paid to the digestive history which was negative. The coincidence of cancer of the gastro-intestinal tract, especially the stomach, and prostatism has been noted by many, and there is a great tendency for the doctor to focus his attention on the urinary tract and to overlook general pathology elsewhere.

On examination we found a decrepit, thin, old man, without teeth, with heberdenization of the fingers, creaking in the major joints, and pipe-stem vessels. The urinary bladder was palpable, three fingersbreadth above the symphysis. On rectal examination moderate uniform soft enlargement of the prostate was felt. Blood-pressure was 152/96; urine moderately infected with the colon bacillus. As is usually the case a soft-rubber catheter of large size was easily introduced and 150 c.c. of residual urine withdrawn. Urine was flowing when this amount had been reached, and gradual decompression undertaken. It is important in catheterization of the prostatic to use some catheter such as rubber or gum-silk which will conform to the eccentricities of the prostatic urethra. Trouble will be encountered if we force the prostate to accommodate itself to a hard catheter. Sometimes it will and sometimes it will not, and then we are apt to get into trouble.

On admission to the hospital he was placed on urethral drainage, and gradually decompressed for eight hours. Section of the vas deferens was done under local anesthesia. The blood non-protein nitrogen was 48 mg. on admission. Intravenous phthalein test, using the usual technic of Dr. B. A. Thomas[1] of Philadelphia in which the urine for three twenty-minute periods of the first hour after appearance are determined separately, gave results of: First period, trace; second period, 30 per cent.;

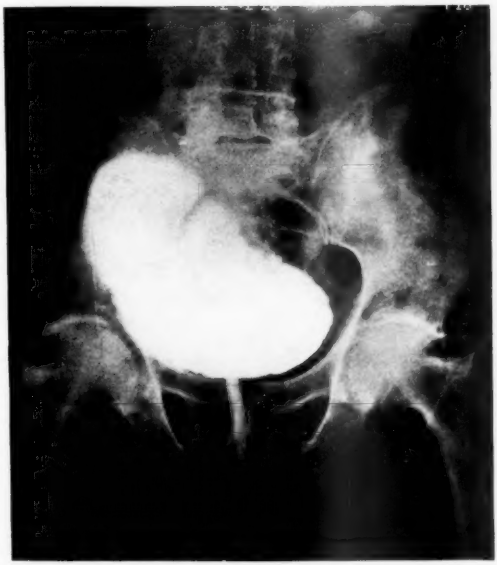

Fig. 126.—This cystogram made with 300 c.c. of sodium iodid shows marked deformity of the bladder caused by two large diverticula.

third period, 6 per cent.; demonstrating a lag in excretion. Routine *x*-ray of the urinary tract was negative. The cystogram which we routinely make, disclosed large diverticula of the bladder (Fig. 126). Cystoscopy accordingly was done and disclosed moderate enlargement of the lateral lobes with small median lobe enlargement, poor emptying force of the heavily trabeculated detrusor and two diverticula. One of the diverticula was situated

above the trigone medial to the right ureter and the other was in the dome of the bladder. The stoma of each diverticulum measured 1.5 cm. in diameter. Under catheter drainage and ingestion of large quantities of fluid, general condition and renal function improved. The blood non-protein nitrogen fell to 38 mg., and the phthalein test for the three twenty minute periods became 18, 10, and 10 on the thirteenth day of treatment. On the seventeenth day the abdominal wall was infiltrated with novocain and the bladder opened. The diverticula were easily found and a finger could be admitted 5.5 cm. in the diverticulum in the dome. Since renal function was still impaired a cystostomy tube was inserted and the wound closed around it. Suprapubic drainage was carried out. On the thirtieth day of treatment, the non-protein nitrogen was 41 mg. per 100 c.c. The phthalein excretion for the first hour was 40 per cent. On the thirty-fifth day the abdominal sinus was opened and the prostate removed.

Convalescence was uneventful from this operation. On the forty-seventh day the suprapubic drainage-tube was removed, and the wound was completely healed on the fifty-sixth day of treatment. On the fifty-seventh day the patient was catheterized for residual urine, and none found. Blood non-protein nitrogen was 35 mg.

Since this time the patient has been well and has worked for eight months. Urine contains about 10 leukocytes per low field. On five occasions the residual urine has been less than 6 c.c. Day frequency is now five to six and there is usually a six- or eight-hour interval at night, so that he usually does not have nocturia. This cystogram (Fig. 127) was made nine months after prostatectomy. Cystoscopic examination at this time showed a smooth conical vesicle neck. Vestigial remains of the diverticula are seen. The trigonal diverticulum is much smaller. A catheter enters 1 cm. before meeting obstruction. The mouth is almost as large as before. The diverticulum in the dome is converted into a cellule. It is 0.5 cm. deep.

It is essential before prostatectomy to have either cystoscopy, or of almost equal value, good *x*-ray studies of the urinary tract

with and without injection of an opaque salt in the bladder. It has been found satisfactory in this clinic to use the latter method unless doubt exists regarding the prostate itself, when cystoscopy is done.

In this case, with imperfect renal function, it was considered unwise at the time to remove the diverticula, so that we decided to remove the obstruction and thus get better drainage and if residual urine persisted or the sinus refused to close, and if renal function improved, surgery of the diverticulum could then be done as a third operation. The functional result from the re-

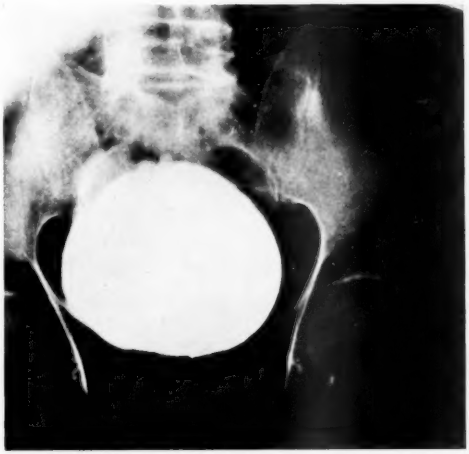

Fig. 127.—Same as Fig. 126, eight months following prostatectomy. No surgery on diverticula.

moval of the obstruction has greatly pleased the patient, and the lack of residual urine and the cystographic and cystoscopic appearances have encouraged us to believe that the conservative plan has been followed. Undoubtedly this procedure has been followed before, both intentionally and through incorrect diagnosis, but has not received proper attention in the literature. For this reason I present this patient, this morning, to demonstrate the improvement that can occur in bladder diverticula from removal of the obstructing factor at the bladder neck.

CASE II.—CONSERVATIVE TREATMENT OF RUPTURE OF BLADDER FOLLOWING INTERPOSITION OPERATION FOR THE CURE OF MARKED PELVIC RELAXATION.

This woman was referred to me in consultation after an exploratory operation for rupture of the bladder following a Watkin's operation. She is fifty years of age, and came to the clinic because of diabetes mellitus, deafness in the right ear, menopausal symptoms, and dribbling of urine on straining. She had had four children and the perineum had been severely torn during the second childbirth, and had been neglected. Since then she has had a feeling of pelvic relaxation with "falling of the womb." At the age of forty-nine catamenia became less frequent and more scanty in amount. On coughing or sneezing there is slight incontinence of urine. On examination, obesity, nerve deafness in the right ear, and slight enlargement of the heart are noted. There was noted marked rectocele and cystocele; a senile cervix; uterus in midposition and atrophic; first degree uterine prolapse. The urine contained sugar. After study the diagnosis of mild diabetes mellitus was made by the medical department. This was controlled, and the perineum was then operated upon. Dilatation and curettage, trachelorrhaphy, anterior and posterior colporrhaphy, and interposition of the uterus of the Watkin's type were done without difficulty.

The immediate convalescence from this operation was excellent except for marked difficulty on urination, requiring catheterization until the eighth day. From this time on urination was relatively free, except for straining. She was out of bed on the tenth day. On the twelfth day she voided about 100 c.c., and noticed immediately a burning pain in the perineum. This became worse, and she complained then of bearing down, crampy low abdominal pain. The abdominal pain became more severe and generalized. The abdomen was distended and markedly rigid. Temperature and pulse remained normal, but there was a leukocytosis of 25,000. She voided small amounts of urine which showed a few red and white cells. The abdomen was opened under ethylene anesthesia six hours after the commencement of abdominal pain, with a diagnosis of intestinal obstruc-

tion. The bladder was moderately distended. The uterus was in interposition. The small intestine was closely adherent to the floor of the pelvis, and on separation of this, a walled-off collection of urine containing over 500 c.c., was found. The tip of a catheter passed through the urethra was seen emerging through a rent in the bladder into the peritoneal cavity. Due to its deep location accurate suture of the perforation was difficult, so that several cigarette-drains were inserted in the pelvis and the abdominal wound closed. The perforation was the size of a quarter dollar and was just above the trigone. The patient reacted poorly to this operation, the pulse was 150 and of weak quality, and there was evidence of surgical shock.

The patient was seen in consultation six hours later, and due to her condition it was decided to treat the bladder rupture by constant catheter drainage. Urethral drainage with a No. 16 F. de Pezzer catheter was carried out for twenty-one days. The temperature curve was relatively smooth, except for a fever of 103° F. on the first postoperative day, which gradually returned to normal on the fourth day. On the seventh day about 90 c.c. of colon-infected pus was let out of the abdominal wound. Otherwise convalescence was normal.

Cystoscopy on the twenty-first day showed a moderate generalized cystitis. The rupture was well healed and it was difficult to see the scar of healing.

This method of treatment of rupture of the bladder (by bladder drainage without suture) has been employed by T. T. Thomas, and especially by A. H. Crosbie.[2] The conservative method of treatment of rupture of the bladder is undoubtedly by laparotomy and suture of the rent, with drainage. Occasionally the tear cannot be closed by suture and here the method of suprapubic drainage alone will cure some of these patients. This case is described because it was Hobson's choice to drain through the uretha since the abdomen had been explored, and adequate bladder drainage or suture not provided. Postoperative shock made cystostomy inadvisable in our opinion. It demonstrates the feasibility of urethral drainage to cure rupture of the bladder.

I do not wish, however, to discourage more extensive surgery when the general condition of the patient will permit.

CASE III.—HYPERNEPHROMA WITHOUT SYMPTOMS OR PHYSICAL SIGNS

This next patient is a woman of forty-four, who came to us three months ago for a general physical examination. She complained of slight headache and vertigo occasionally on arising in the morning. Otherwise, she has been enjoying her usual good

Fig. 128.—Marked distortion of the pelvis and calyces in hypernephroma.

health. There have been no urinary symptoms, or symptoms referable to the chest or abdomen. She has gained 3 pounds in the last two months. Physical examination was entirely negative, except for the right upper quadrant, where the lower border of the kidney was palpable 5 cm. below the costal margin. It was not tender, was smooth, and regular in outline, and moved on respiration. The urine contained a trace of albumin, an occasional hyaline cast, and was free from red cells on three examinations.

An *x*-ray of the kidney region showed a low placed right kidney. Cystoscopy was done. "The bladder is normal, both ureters are easily catheterized. Differential phthalein function: $7\frac{1}{2}$ per cent., left 18 per cent., in ten minutes." This is the right pyelogram made of the right kidney (Fig. 128). The left pyelogram is normal. As you see there was no Roentgen evidence of metastatic malignancy of the lumbar vertebræ, pelvis, or chest.

Fig. 129.—Grawitz tumor of upper pole of kidney. Note the lower half, which was the only portion of the kidney palpable, is normal.

An exploration of the right kidney through an oblique translumbar incision was done six weeks ago, and showed a nodular tumor of the upper pole of the right kidney the size of a small grape-fruit. The lower two-thirds of the kidney is normal (Fig. 129). As much of the perirenal fat as possible was removed. The operation was technically easy. The wound was drained with a rubber Penrose drain for five days.

Section shows a typical Grawitz tumor (hypernephroma), which had not invaded the renal pelvis.

The wound, as you see, is well healed. The patient has been active for two months, and feels well.

This case is interesting because the tumor was symptomless, and was an incidental finding in a periodic health examination. The Grawitz tumor is slow growing, and the classical triad—tumor, hematuria, and pain are seen rather late. Pain due to infiltration of surrounding tissues is a particularly bad sign as it occurs late in the disease, in marked contrast to adenocarcinoma of the kidney where infiltration occurs early.

The early diagnosis must rest on pyelography. It seems in the present state of our knowledge, and especially in view of cases like these which are not at all rare and bizarre oddities, that all palpable kidneys should be entitled to the benefit of pyelography, especially if there seems to be any enlargement. We feel that properly conducted unilateral pyelography carries with it practically no danger and only moderate inconvenience. It may seem not conservative to pyelogram normal kidneys, but in our opinion it is much more radical to overlook early malignancy and hydronephrosis, and as far as is known, pyelography is the only method for the early diagnosis of renal malignancy.

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CLINIC OF DR. GOLDER L. McWHORTER

PRESBYTERIAN HOSPITAL

AMEBIC ABSCESS OF THE LIVER. REPORT OF CASE WITH RECOVERY AND A STUDY OF SEVEN OTHER CASES FROM THE RECORDS OF THE PRESBYTERIAN HOSPITAL

THE prevalence of amebic infection has been emphasized in the literature from time to time in the past twelve years. The infrequent occurrence of a dysentery in cases developing amebic abscess of the liver makes the diagnosis difficult. The case which I have recently operated upon is a rather characteristic one.

Case Report.—H. M., No. 223734, male, age forty-four years, entered Presbyterian Hospital April 28, 1928. Chief complaints were fever, swelling and pain in the right upper quadrant, weakness, and loss of weight.

The onset of the present acute illness began about four months ago, while he was in South America, with a gradual loss of strength and weight, and with slight fever. There was no pain at the onset. Swelling in the region of the liver was noticed about one month later with tenderness, and occasional sharp, knife-like pains. He gradually became worse and went to a hospital. During his two months' stay in the hospital he became gradually weaker and lost 25 pounds. He made the long ocean trip, arriving in a critical condition.

Amebæ were found in his stools while in the hospital in South America and a diagnosis of amebic abscess of the liver was made. During the three weeks preceding his leaving, he received 0.06 gram of emetin every second day for ten injections. Before that he was given 2 pills of yatren three times a day, and several injections of polyvalent vaccine and a serum. His temperature

chart during the last three weeks was normal, while before that, he occasionally had intermittent attacks of fever.

Previous symptoms of a similar mild character began about two years ago, on his return from South America when he had a slight fever for several weeks, with a tired feeling, and constipation.

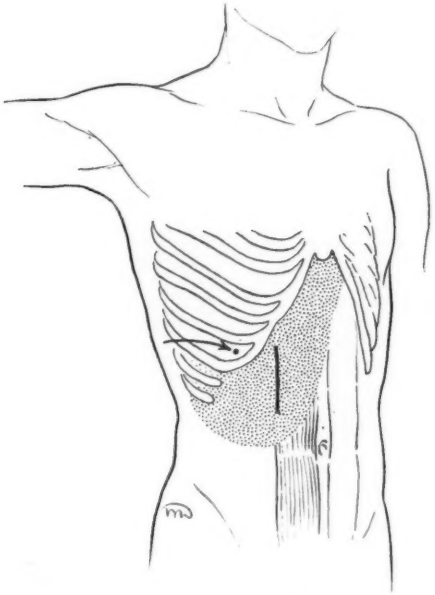

Fig. 130.—Diagram illustrates the enlargement of liver downward as evidenced by a palpable swelling. Arrow points to exploratory aspiration and introduction of a catheter for drainage. Line of abdominal incision is shown through which a second larger tube was introduced into the center of abscess for drainage.

Careful study in a hospital here revealed no ameba or other cause for his symptoms. One year ago upon returning to South America he had an acute attack of illness with a swelling and tenderness in the region of the liver and belching of gas. This cleared up after five days in the hospital. There have been no other attacks until the present illness.

Bowels have been constipated, especially in the past two years, with an occasional mild attack of diarrhea. During the past three months he has been more constipated and has found relief only upon taking magnesium sulphate every morning.

Past Illness.—General health has otherwise always been excellent. He had a slight frontal sinus infection three years ago, and an operation for a hernia ten years ago.

Family History.—Mother died of tuberculosis. Father died of carcinoma of the liver.

Physical Examination.—The patient was a tall, emaciated, very sick appearing man.

Abdomen.—A swelling was palpable and visible over the right upper quadrant with a rounded margin resembling that of an enlarged liver (Fig. 130). There was marked tenderness and muscle rigidity.

The chest and other examinations were negative.

Laboratory Examinations.—Blood: white blood-cells 15,800, hemoglobin 60 per cent., red blood-cells 4,324,000.

Stools, urine, and Wassermann were negative.

Roentgenograms of the chest were negative.

Operation on May 1st, under ethylene anesthesia. An aspirating needle was inserted in the anterior axillary line, through the intercostal space below the diaphragm, and pus obtained. A trocar was inserted along the needle and about 1 pint of thick, purulent material was removed. There were some chunks and some areas of clear mucus-like material.

An incision was made through the rectus just below the costal arch, and a markedly swollen liver extending about 4 inches downward was exposed (Fig. 130). The gall-bladder was thickened and edematous, but was compressible. There was a large depressed, fluctuating area in the right lobe of the liver above the gall-bladder. An iodoform gauze pack was placed about this area including the trocar. A needle was then inserted into the center of the liver abscess. The anesthetic was changed temporarily to ether and an electric cautery point was used to make an opening along the needle through which a thumb-sized fenestrated rubber tube was pushed into the cavity. The tube fitted

tightly without leakage. A No. 18 rubber catheter was inserted through the trocar opening in the intercostal space into the abscess cavity 3 or 4 inches above the other tube. The gauze pack surrounded both tubes and the abdomen was closed around the gauze and the large rubber tube. Both rubber tubes were fixed to the skin with silkworm-gut.

Postoperative Treatment.—The patient had some shock and a subnormal temperature. He required fluids subcutaneously for two days. There was no evidence of peritonitis. Repeated irrigations several times a day were done by injecting a solution of boric acid through the smaller tube. The thick necrotic material from the abscess cavity was washed out from the larger tube. This irrigation was continued until the tubes were removed. At the end of three and one-half weeks the character of the discharge had changed, there being present only a few chunks of necrotic material with a more clear, slightly bile-tinged fluid. The tubes were shortened gradually and removed entirely two and one-half months after the operation. There was no drainage during the last ten days except a small amount of clear bile-colored fluid. This stopped after removal of the tubes.

The thick purulent material removed from the liver abscess contained no bacteria on culture or smears, and no ameba was found in it. It consisted of débris and necrotic material with few cells. Two weeks later living amebæ were found on separate days in the discharge from the abscess cavity. Emetin injections were started three days later, and with the exception of one non-motile ameba seen on the fourth day, no others were found in the discharge on repeated examinations. After the first three weeks following operation the patient was given alternately yatren, stovarsol, and emetin.

It is interesting to note that after the first drainage of the old necrotic liver abscess material, amebæ were found repeatedly until after the first two or three injections of emetin. At this time the character of the discharge became thinner as well as free from ameba. During this period the patient gained rapidly in weight for the first time. During the second course of emetin the discharge became bile-colored and scantier, and stopped en-

tirely upon the removal of the tubes. No clinical change or variation in the discharge was observed with the other medication he received. He was discharged with no complaints on July 18, 1928. His weight at this time was 154 pounds, a gain of over 45 pounds.

Case Records.—The following study was made from the case records of 8 patients having amebic abscess of the liver (see Table, p. 390), including the one reported, which were all that could be found in the files of the Presbyterian Hospital.

Etiology.—The patients were all males varying in age from twenty-seven to forty-eight, and they averaged thirty-three years of age. No clue to the source of the amebic infection was given, except in Case VI, where his chronic illness followed immediately the drinking of some water which he concluded was very bad. In my case the onset definitely followed a trip to South America with a recurrence on other visits. The others developed their symptoms in this country. The patients were of various nationalities.

Pathology.—A necropsy was performed in 4 cases, and in all of the others an operation was done except Case VI where two aspirations established the diagnosis. A large abscess was located in the right lobe in all instances, usually protruding below the costal arch as a distinct swelling. The size varied froma cavity holding 200 to 1000 c.c. Terminal abscesses developed in Case III with staphylococci and amebæ also present in the liver, brain, and lung. No active colitis was noted at necropsy, but a healed colitis resembling that of ameba was found in Case II. No bacteria were found in pus from the liver at operation; however, a pyemia developed in Case III after aspiration and multiple abdominal abscesses in Case VII following operation.

Symptoms.—There were previous attacks of abdominal distress in 6 cases over a period of two months, in 1 slight attacks over six months, and in my case possibly two years.

The onset was acute in 3 cases, in 2 of which it followed a cold and sore throat from exposure. It was subacute in 1 and chronic in the remaining 4 cases. The duration in the cases having the

Case.	Hospital.	Sex.	Age.	Symptoms.	Operation.	Ameba found.	Remarks.
1	122,488	M.	31	Attack 2 months ago, second attack 10 days ago. Acute over liver. Diabetes 5 years.	Abdominal drainage abscess.	In liver abscess. In stools.	Died two days later, aggravated diabetes mellitus. Necropsy.
2	182,552	M.	47	Chronic pains 4 months over liver. Loss 45 pounds in weight.	Abdominal drainage 4 days after area walled off with gauze.	In stools. None from liver abscess.	Died two hours after drainage operation of pulmonary embolism. Phenoltetrachlorphthalein present in clot. Necropsy, healed (?) amebic colitis.
3	186,335	M.	44	Chronic pains 2 months. Loss of 40 pounds weight. Terminal pyemia with Staphylococcus albus in blood.	Unsuccessful needling of liver. No operation.	At necropsy amebæ found in abscesses in liver, brain, lung, and wall of colon.	Died. Necropsy generalized abscesses all containing both ameba and hemolytic Staphylococcus albus.
4	149,575	M.	29	Attack 2 months ago. Second attack 5 days ago. Acute over liver.	Abdominal drainage abscess.	In stools. None found in liver abscess.	Cured. Discharged in 4 weeks complicated by pneumonia and empyema requiring drainage.
5	81,364	M.	30	Subacute pains 2 months over liver.	Aspiration of abscess. Abdominal drainage 4 hours later.	In liver abscess.	Cured. Tubes out 4 weeks. At operation, 4 hours after aspiration, free pus was present in abdomen.
6	43,203	M.	48	Mild attacks 5 weeks. Acute 5 days over liver. Terminal amebic peritonitis.	Exploratory aspiration of abscess. No operation.	In liver abscess. In peritoneal pus at death. In stools.	Died in acute shock 12 hours after aspiration of abscess. Amebic pus aspirated from peritoneal cavity at time of death.
7	66,842	M.	27	Chronic pains over liver 6 months. Loss of 30 pounds weight. Occasionally slight diarrhea, but not recently.	Abdominal drainage liver abscess. Reoperated twice for localized suppurative peritonitis 2 weeks and 2 days later.	In liver abscess.	Died 7 weeks after operation with sepsis from extensive suppurative peritonitis. Necropsy.
8 writer's case.	223,734	M.	44	Three attacks over 2 years. Acute attack 4 months. Loss of weight, constipation, rarely a diarrhea.	Abdominal drainage.	In liver abscess. In stools 3 months previous to operation.	Cured. Drainage stopped 2½ months after operation. Well six months later.

acute attacks before entering the hospital was five to ten days. On entrance they had either a high fever or prostration. The fever varied from 100° to 103° F. It was usually 101° or 102° F., and intermittent in character. Pain was usually noted from the onset of symptoms, either of a severe or colicky character. In Cases VII and VIII there was rapid loss of weight for one to three months before pain was noted. It was usually localized along the right costal border of the abdomen. In Case VII it was also referred to the right scapula, and in some others to the right side of the chest. It was aggravated on deep breathing in a couple of instances. A swelling was observed in the right upper quadrant by 3 patients. Loss of weight was rapid in all cases. Several patients lost 40 pounds in two months. A marked weakness was constantly noted. In no instance was there a complaint of bowel distress or annoying diarrhea. Cases VII and VIII admitted having a few attacks of diarrhea, but not recently, and Case VIII complained of constipation. In spite of the absence of bowel symptoms, amebæ were found in the stools of 6 patients.

Cort[1] stated that there was no history of previous attacks of dysentery in 18.5 per cent. of all cases in which he diagnosed amebiasis of the liver.

Vomiting and distress after eating were occasionally present. Loss of appetite was frequent. There were a few attacks of pain sometimes of a colicky character in the upper abdomen lasting a few days, with an interval free from symptoms in most of the cases. In a couple of cases they were never entirely well after the onset of the attacks of abdominal distress.

The white blood-count varied from 5800 to 28,000. It averaged 14,500 in all of these cases. The hemoglobin was frequently low, 50 to 60 per cent. in several instances. It was observed that in the case with the highest white blood-count the highest fever was only 101° F., while the case with a count of 5800 had a maximum fever of 102° F., and the case with a count of 11,000 a fever of 103° F. The rather characteristic finding of a high white blood-count with a low fever and a low count with a high fever occurred not only in this group of amebic abscesses,

but also in a larger number of case records from non-amebic abscesses of the liver. This unusual relation may offer some help in the differential diagnosis of liver abscess.

Prognosis.—Five of the 8 patients died, a mortality of 62 per cent. The effect of medical treatment with emetin can scarcely be determined from this group, since only my case received it, and he only had ten injections with little improvement before operation. However, following drainage, improvement with absence of ameba in the liver was noted shortly after starting the emetin injections. In all 8 cases marked weakness and toxemia made them poor operative risks. However, the non-operated cases all died. Pulmonary embolism was the immediate cause of death in Case II. In this instance phenoltetrachlorphthalein which had been injected on two occasions for a liver function test was found present in the clot which had arisen from the wall of the femoral vein. The dye may have predisposed to this thrombosis (L. C. Gatewood[2]). Diabetes mellitus which had been present for five years became aggravated and predisposed largely to the death in Case I. A generalized amebic and secondary staphylococcus pyemia developed in Case III following unsuccessful needling of the liver. Acute shock and death in Case VI, followed twelve hours after a needle aspiration of the abscess. At death free purulent material containing amebæ was found in the peritoneal cavity. The development after drainage of a localized suppurative peritonitis of the upper abdomen with several weeks in a septic condition, led to death in Case VII. A needle aspiration in Case V was followed in four hours by an exploratory operation in which amebic pus from the liver abscess was found throughout the abdomen. This patient recovered, following drainage. Operation with drainage of the amebic abscess alone or shortly after an aspiration resulted in a mortality of 50 per cent. Where unoperated, or where exploratory aspiration alone was done, all died. In none was there evidence of secondary infection on entrance to the hospital or at operation. The infection in one case followed operation, and the other occurred after repeated unsuccessful needling of the liver.

Treatment.—Medical treatment with emetin by hypodermic injections has been shown to be of specific value in the treatment of amebic infection of the liver. Cort[1] reported 17 cases of liver abscess which were aspirated or ruptured spontaneously in conjunction with emetin treatment, with recovery. He diagnosed amebic infection of the liver in 97 cases out of a total of 530 cases diagnosed as amebiasis. He stated that adequate emetin treatment cures all cases of amebic hepatitis and in the presence of large abscesses converts them into good surgical risks. Cort believed that aspiration, repeated if necessary, was the safest method of treating large abscesses. However, he reported one case which developed severe shock with a hemorrhage from the trocar during aspiration.

Dowling[3] stated that hypodermic injections of emetin were not uniformly successful in freeing the stools of amebæ and that a painful sensory neuritis was a constant danger. He was successful in freeing the stools of amebæ by one series of twelve daily doses of 3 grains of emetin bismuth iodid in a keratinized capsule. It was necessary to put the patient to bed and precede the drug by an opiate.

Exploratory aspiration of the liver with a needle resulted in a leakage of the abscess contents into the peritoneal cavity in Cases V and VI. Case V was undoubtedly saved by an exploratory operation with drainage four hours later. It is possible that the unsuccessful repeated needling of the liver predisposed to the pyemia in Case III.

It is evident that aspiration should be attempted cautiously under operating room technic with the smallest caliber needle possible. A short beveled, rather dull tip should be preferred. If pus is obtained, drainage should be instituted immediately by operation or by a catheter inserted through a blunt-tipped trocar in order to avoid leakage. Either the transpleural or abdominal route may be chosen depending upon the location of the abscess, but in case of choice the latter is preferable. A two-stage operation in order to produce adhesions with walling off of the pleural cavity is usually indicated. It may also be done with abdominal drainage. After exposure of the liver the cautery may prefer-

ably be used to make an opening for a drainage tube in order to avoid the danger of hemorrhage.

The operative treatment in this group of 6 cases was abdominal drainage of the abscess through a rubber tube surrounded usually by gauze. In the cases that recovered, drainage was good, and the tubes were removed after the discharge had stopped.

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CLINIC OF DR. PERCIVAL BAILEY

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WOUNDS OF THE SUPERIOR LONGITUDINAL SINUS

I PRESENT this morning a young man with a rather unusual and instructive injury to the head.

He is a young man of twenty-two years, always well until his present accident. He was struck by an automobile while crossing the street and, although thrown rather violently to the ground, was not rendered unconscious. The automobilist carried him to a nearby hospital where some minor bruises were dressed and he was immediately discharged. On returning to his residence he vomited and seemed to be dazed. Gradually he became more stupid, and was brought by a friend to the Billings Hospital where he was admitted (No. 6905) in the evening of September 20, 1928.

The patient was semiconscious. There was no bleeding from ears or nose and no abrasions about the head. The pupils were equal and reacted normally. There was no sign of focal injury to the nervous system. The pulse-rate was 100, and the blood-pressure 124. *x*-Rays of the head were taken; he was put to bed; thoroughly wrapped in warm blankets, and 50 cm. of a 50 per cent. solution of glucose was given intravenously. The following morning he seemed brighter; pulse 86, blood-pressure 120, respirations 24. During the day his pulse-rate gradually dropped to 58; the respirations to 16; the blood-pressure rose to 140; and he complained of severe frontal headache. Another injection of 50 cm. of the glucose solution promptly improved his condition.

Meanwhile the *x*-rays had disclosed a separation of the sagittal suture-line (Fig. 131) and a linear fracture extending from just above the right supra-orbital ridge upward and to the left across the midline 15 cm. behind the nasion (Fig. 132), with very

slight outward displacement of the anterior fragment. The scalp began also to have a soft boggy feel, and pitted on pressure; there was no discoloration, but this condition was thought nevertheless to be due to a subaponeurotic hemorrhage, giving evidence, together with the location of the fracture, of an injury to the superior longitudinal sinus.

The last intravenous injection raised the pulse-rate only temporarily. Lumbar puncture was therefore done September 22d at 1 P. M. The fluid was bloody and under high tension.

Fig. 131.—Anteroposterior radiograph showing fracture in right frontal region and separation of the sagittal suture.

Thirty-five cc. of fluid was removed, and the last which escaped was much less bloody. The transformation in the patient's condition was prompt. The pulse-rate rose to 84; the patient became alert and responsive; complained of hunger, and ate heartily.

The pulse-rate soon returned to about 50, and remained at this level, although the respiratory rate was 20, and the blood-pressure never over 130. The patient remained conscious and orientated; ate and took fluids satisfactorily, but was restless and complained

of severe headache. Two other lumbar punctures were done which produced only temporary improvement, and the fluid removed was increasingly clear. There was by this time also discoloration around the mastoid region on both sides. No evidence of any localized injury of the nervous system was found at any time.

A diagnosis of extradural clot from injury to the superior longitudinal sinus seemed certain and operation was thought

Fig. 132.—Lateral radiograph to show location of fracture and slight displacement of anterior fragment.

necessary. Consequently under ether anesthesia an osteoplastic flap was reflected (September 23) over the midline with its base backward as you can see (Fig. 133) and its anterior margin over the juncture of the fracture with the sagittal suture. The subaponeurotic tissue was thickened to $1\frac{1}{2}$ cm. by infiltration with blood. As soon as the first burr-hole was made it was evident that there was actually an extradural clot. When the bone-

flap was broken back several large clots 2 to 3 cm. in diameter escaped together with a large amount of dark fluid blood mingled with smaller clots. In the anterior portion of the exposed dura mater blood was flowing in a steady stream from a ragged tear about 3 mm. in length in the longitudinal sinus. This bleeding was controlled by pressing a piece of muscle, removed from the patient's leg, upon the opening. It was then possible to investigate the extent of the extradural hemorrhage which was found to extend far forward over the right frontal lobe. The area was

Fig. 133.—Cranial wound twelve days after operation. Note position of flap with base behind.

cleaned by irrigation and suction. There was no sign of arterial bleeding.

The flap of bone had been divided into three fragments by the fracture and by the separation of the sagittal suture. The smaller one, practically detached from the scalp, was removed and the wound sutured.

The postoperative recovery was slow, but steady. The pulse-rate remained around 60 until September 26th, and then gradually rose to 90. He feels perfectly well now two weeks after op-

eration and will soon be allowed to go home. The bone-flap is in excellent apposition.

Because of the peculiar structure of the venous sinuses of the dura mater they demand special management when injured. Although lined by endothelium they are simply lacunæ lying usually where one sheet of the dura mater joins another at a right angle. In cross section they are triangular therefore, and their walls are held rigidly open by the dura mater so that they cannot collapse when injured. Moreover their walls contain no elastic tissue. Also one side of the triangle at least is adjacent to the inner surface of the skull so that any injury to the latter causing its displacement is apt to tear the wall of the sinus

The sinuses are not equally liable to injury. Leaving aside the lesions of the lateral sinus due to surgical diseases of the mastoid cells, and confining our attention solely to the traumatic injuries, we find that the longitudinal sinus is most often injured; the lateral sinus comes next in order, while the cavernous, straight, and transverse sinuses are rarely affected.

Before we go further we must pause to note that the classical example of extradural hemorrhage, said to be due to rupture of the middle meningeal artery, is often, perhaps usually, due in reality to laceration of the accompanying veins—the so-called *sinus sphenoparietalis of Breschet.* This fact was first pointed out by Merkel, independently by Trolard, and finally established by Wood Jones who found that "it was quite impossible to cause any extensive separation of the dura mater from the bone without some degree of laceration of the venous sinuses, while in this process the artery remained uninjured." That the bleeding is venous in origin undoubtedly explains the numerous cases which have recovered from simple removal of the clot or light packing so that Krönlein was able to insist that the finding of the clot was more important than finding the bleeding vessel. We should, perhaps, rectify our statement above, therefore, and conclude that the sinus most frequently injured is the sinus sphenoparietalis.

The cause for the frequent injury of these three sinuses—sinus longitudinalis, sinus lateralis, and sinus sphenoparietalis—

is doubtless to be sought in their exposed position. Marchant divides the dural sinuses into hidden and exposed (*sinus cachés* and *sinus découverts*). In the latter class he includes the longitudinal and lateral sinuses.

Another anatomic peculiarity of the longitudinal sinus exposes it to frequent injury, and that is the presence of large lacunæ opening into it from either side. First mentioned by Faivre, they were carefully described by Trolard (1868) and have recently been studied especially by Sargent. He found that the superior lateral veins of the cerebral hemispheres unite usu-

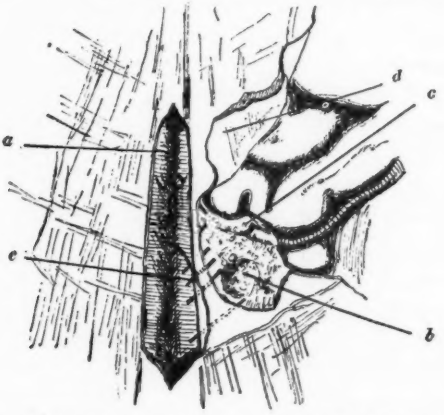

Fig. 134.—Parietal lacuna of superior longitudinal sinus: (*a*) Sinus with dorsal wall removed; (*b*) large pacchionian granulation; (*c*) valve-like opening of a cerebral vein into the lacuna; (*d*) dura mater reflected; (*e*) glass rods placed in openings of lacuna into the sinus. (After Sargent and Holmes.)

ally into four principal trunks—a frontal, a precentral, a postcentral, and an occipital. The postcentral is usually the largest and most important since it drains the central gyri. As a rule these veins open into thin walled lacunæ that project over the lateral as well as the mesial surface of the hemisphere. There are generally three lacunæ, a small frontal one receiving the frontal vein, a large parietal one receiving the pre- and postcentral veins (Fig. 134) and a smaller occipital one into which opens the occipital vein. Sometimes the lacunæ are fused in

various ways. They discharge their blood by several small openings into the sinus, and are more extensive than is generally supposed; the parietal lacunæ may spread as much as 2.5 cm. over the convexity of the hemisphere. These lacunæ increase greatly the area over the vertex of the skull within which an injury may involve the venous circulation of the dura mater.

There is another lacuna quite constantly to be found in the sphenoidal fossa between the middle meningeal veins and the great anastomotic vein. It opens into either vein, ordinarily into the anastomotic, but sometimes into the middle meningeal, itself sinusoidal in this region.

The lacunæ contain great numbers of pacchionian granulations, and so are doubtless of great use in the absorption of cerebrospinal fluid. The cerebral veins may open into the sinus directly, but usually into the floor of the lacunæ. Luys has shown that the veins in the frontal region open into the sinus in a backward direction while those in the occipital region are directed forward (Fig. 135). This anatomic peculiarity is doubtless due to the excessive development of the frontal and occipital poles of the brain after the cerebral veins have formed their connection with the sinus.

The longitudinal sinus is usually injured by direct violence; such injuries were common during the recent war. But laceration may result from bursting fractures as in the patient I have just shown you, or even from transmitted force without fracture. It is sometimes torn in infants during birth; Litzmann has twice observed such tears in cases of narrow flat pelvis. The most frequent cause is undoubtedly penetration of fragments of bone from depressed fractures of the vault.

The **symptoms** of injury to the sinus are most varied. If the wound is open to the exterior, death may result from external hemorrhage. Ordinarily, however, the opening is more or less closed by the fragment of bone producing the lesion, and the hemorrhage soon ceases. Hence the danger of removing fragments of bone in cases of depressed fracture in the region of the sinus. It is said also that if the hemorrhage continues, and especially if the patient be in a sitting posture, air may enter the sinus

in sufficient quantity to produce death by air embolism (v. Bergmann), but this usually occurs when a sinus is opened at operation.

If the external exit is stopped by a bony fragment or packing and the tear extends into the subdural or subarachnoidal space, death may ensue from increasing intracranial tension. This may

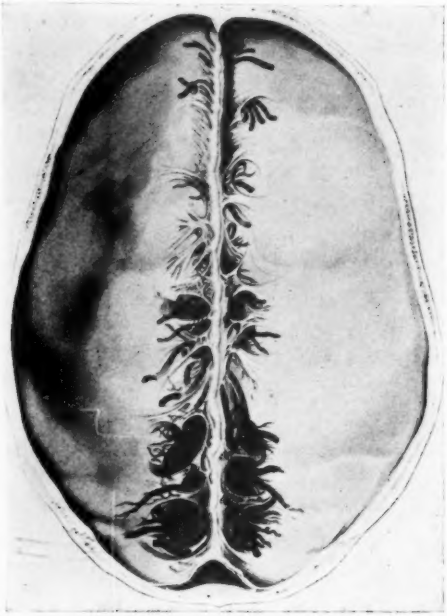

Fig. 135.—Inner surface of the dura mater showing the veins emptying into the sinus longitudinalis. Note that the frontal veins enter the sinus in the direction of the blood flow, while parietal and occipital veins enter against the current. (After Luys.)

also occur spontaneously if there is no open wound. Compression of the brain may be caused also by extradural bleeding as in the case we have just seen, but extradural clots from injuries to the longitudinal sinus are rare. From the lateral sinus they are more common, especially in the posterior fossa. Wharton (Case IV) reports such a case. The patient was operated upon and re-

covered. I have myself operated successfully upon a very similar case in the Clinic of Dr. Harvey Cushing. But the only cases of extradural clot similar to the one I have just shown you that I have been able to find in the literature are old ones of Guthrie and of Chassaignac.

The infrequency of extradural clot following injury to the superior sinus is due doubtless to the firm attachments of the dura to the skull in this region. Once such an extradural hemorrhage begins, there is little to hinder its extension to the base of the skull. The collection of the clot over the frontal lobe might explain a certain silly facetiousness which we had noted in this boy previous to operation, but had not emphasized. This mental alteration is frequently observed in cases of tumor or injury to the frontal lobes.

When there is no wound of the scalp giving exit to the exterior the blood may accumulate under the galea aponeurotica as in the case you have just seen, and if the opening in the sinus remains open, a soft pulsating mass may be palpable under the scalp even years after the accident. This condition has been called by Stromeyer *sinus pericranii*. Such a condition is sometimes congenital, but Lannelongue has collected 7 cases due to trauma to the longitudinal sinus.

I have told you how the venous blood from the superior part of the cerebral hemispheres drains through the lacunæ into the longitudinal sinus. In case a thrombus should form in the sinus, as not infrequently happens, this venous circulation would be seriously interfered with, resulting in serious defect of nervous function. Holmes and Sargent have described the disturbances which follow a block of the parietal lacuna and its tributaries. A hemiplegia or paraplegia, even a quadriplegia, may result, and the paralysis has an unusual distribution, differing from that seen in the usual paralysis due to hemorrhage or thrombosis of cerebral arteries, in that the more proximal segments of the upper limbs are most seriously paralyzed, the weakness diminishing distally. In the legs the converse is true; here it is always the distal movements that suffer more severely.

Infection of the wound may result in pyemia or septicemia,

but this outcome is less common than it was in the days before aseptic surgery.

The **diagnosis** of wounds of the dural sinuses must be made largely by the site of injury and the character of the escaping blood. Where there is no external wound the diagnosis may be aided by the *x*-rays or the nature of associated neurologic symptoms pointing to local lesion of the brain. That the bleeding is venous in these cases may be suspected from the slower development of the symptoms.

The **treatment** of wounds of the sinuses presents many difficulties. The removal of depressed fragments of bone should be done with the utmost circumspection. There are very numerous records of death from hemorrhage following removal of bony fragments which have penetrated the sinus, and which did not cause much bleeding because they plugged their own openings. Such a removal should only be done by turning down an osteoplastic flap, as was recommended by de Martel for all penetrating wounds of the skull. In wounds of the sinus the indication is clear, for if the surgeon has not the injury freely in view, a fatal hemorrhage is to be feared. In fact, it is probably wise, contrary to the rule elsewhere in the intracranial cavity, to leave depressed fractures in the region of longitudinal sinus alone unless an open wound causes fear of infection or symptoms of injury to the brain or of intracranial tension render operative intervention advisable.

The method of dealing with a tear in a dural sinus, once it is well exposed, varies in the different cases. Usually packing with gauze has been resorted to. In our case the tear was small and the opening was readily closed by a bit of muscle. This procedure for stopping venous bleeding was first used by Sir Victor Horsley. But for a larger wound this ingenious method would not have sufficed, although larger pieces of muscle may be held in place by sutures passing across the sinus and caught in the dura mater on each side. Ligation has been done successfully, but it is not easy to pass a ligature around the longitudinal sinus because of the danger of lacerating venous trunks in the underlying brain, and the ligature once passed is not very successful

in occluding the sinus because of its triangular shape and rigid walls. Cases have been reported in which wounds have been sutured with fine silk. This must be difficult in the presence of the profuse hemorrhage which results from a tear of any size. In other cases the surgeon has caught the wounded sinus with hemostatic forceps which were allowed to remain two or three days. Often severe hemorrhage has accompanied their removal.

The most useful method of dealing with large wounds seems to be to invert the outer wall by pushing into the sinus a rounded object which is retained by pressure or suture. This method was first recommended by Macewen and has been applied to the lateral sinus by Eagleton.

Wounds of the dural sinuses are fortunately not excessively common, but let me not terminate this presentation without pointing out that this young man illustrates a more common lesson in regard to injuries of the head, but one which cannot be too often repeated, namely, that every case of head-injury, no matter how trivial it may seen at the time, must be kept under strict observation for several days and not simply dismissed with a first-aid dressing.

CLINIC OF DR. C. M. VAN ALLEN

ALBERT MERRITT BILLINGS HOSPITAL

EMPYEMA WITH MULTIPLE FOCI

THE patient, female, age forty-seven years, entered the hospital four weeks after the onset of illness. This began with rhinitis, sore throat, and cough. These symptoms continued a few days, when she became very ill with high fever. The cough increased, and she expectorated moderate amounts of light brown sputum. Pains were experienced in the chest, but without localization. This condition continued for two weeks, when improvement gradually set in. Ten days ago, however, the chest pain increased suddenly and localized in the right side, aggravated with each breath. The fever returned to its former high level and she was again very ill, although there was now no cough. After about thirty-six hours the pain disappeared. A physician was now called for the first time (an osteopath had been attending), and a large fluctuating mass was found behind the right shoulder. From this a pint or more of pus was aspirated on three occasions. The fever continued, however, to mount and the patient grew weaker.

The past history is unimportant, except for frequent colds and sore throats. Although always slender, she had considered herself robust. There had been no unusual exposure to tuberculosis.

Examination revealed an emaciated and very sick woman, alert and co-operative. The findings were not pertinent except as regards the chest. There was a diffuse swelling in the back medial to the right scapula, extending from the base of the neck to the level of the tenth dorsal spine. This was warm to the

touch, but not red. It fluctuated and was tender. The medial scapular margin was distinctly elevated thereby, and the scapular movements limited and painful. Respiratory movements were limited on the right side of the chest. Percussion elicited dulness anteriorly in the infraclavicular region and in the axilla. Vocal and tactile resonance was lost over these areas, and breath-sounds were distant and tubular. No râles. Posteriorly, lung signs were masked by the fluctuant mass. The left side of the chest was normal, and the heart presented nothing abnormal. Temperature 100.6° F., pulse 116, respirations 26.

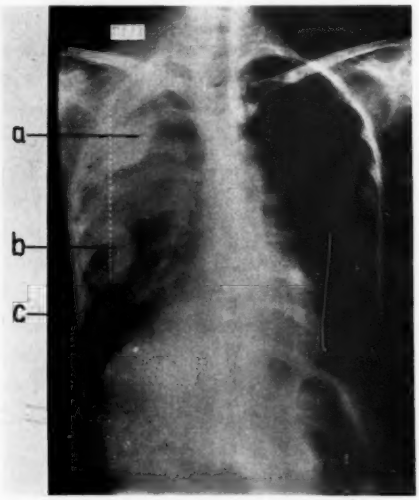

Fig. 136.

Laboratory: Blood-pressure, 100/62. Erythrocyte count, 3,800,000. Leukocyte count, 30,400; 90 per cent. polymorphonuclear leukocytes. Hemoglobin, 68 per cent. Urine, normal.

Roentgen ray: The anteroposterior view of the chest (Fig. 136) showed three circumscribed dense areas in the right lung field, one near the apex at *a;* another, larger than the first, situated in the axillary region at *b*, and the third, smaller, placed at

the base at *c*. The lung elsewhere was slightly clouded. Left lung normal. The lateral view (Fig. 137) demonstrated the same dense areas, the first anteriorly, the second laterally and posteriorly, and the third centrally over the diaphragm. There could be seen, also, the profile of the fluctuant swelling in the back at *d*.

Preoperative diagnosis: Acute empyema with multiple foci and perforation into the chest wall (empyema necessitatis).

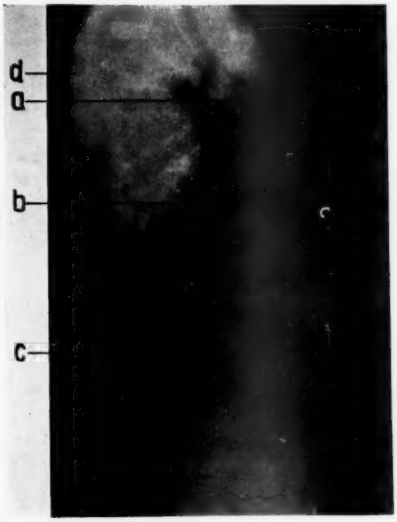

Fig. 137.

Operation was done immediately, employing local anesthesia by infiltration and intercostal nerve-block. Thoracentesis was first made at the right scapular apex without results. At one interspace below this the needle withdrew thick yellowish-green pus. Ten centimeters of the underlying rib was resected and the rib bed opened into, exposing an empyema cavity which contained about 300 c.c. of the same type of pus; Figs. 138, *b* and 139, *b* indicate the distribution of this cavity. Since its lower limit was below the thoracotomy wound, another rib was removed and dependent

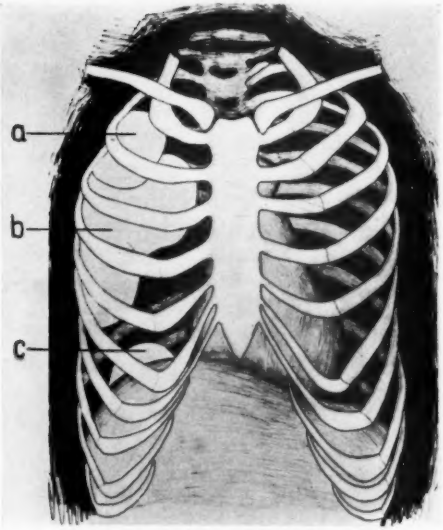

Fig. 138.

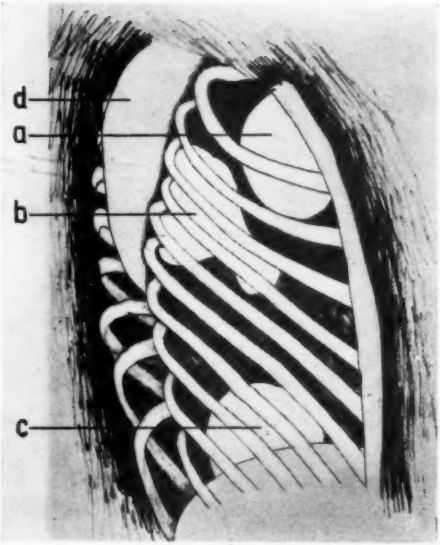

Fig. 139.

drainage secured. After cleansing the cavity a large drainage-tube was secured in the wound. Two incisions were then made over the dorsal swelling, and an accumulation of about 400 c.c. of yellowish-green pus was found beneath the scapula and its muscles. No communication was discovered between this space and the chest cavity, but a thorough search was not made on account of the patient's condition. Drainage-tubes were placed.

The postoperative reaction was not severe (Fig 140).

Second operation, eight days later: Local infiltration anesthesia. Thoracentesis in the second interspace anteriorly, 2 inches from the right sternal margin, withdrew thick yellowish-

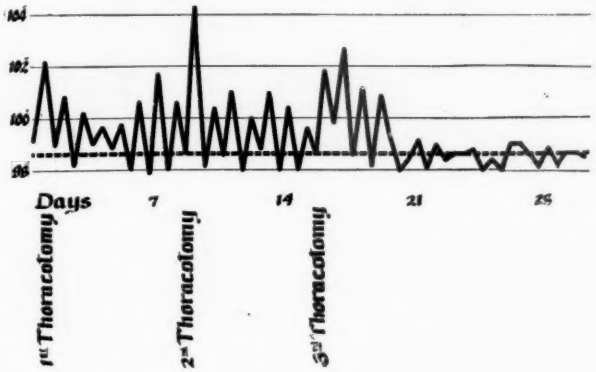

Fig. 140.

green pus. The second rib was then resected at this point and an empyema cavity opened into, containing about 25 c.c. of pus (Figs. 138, *a* and 139, *a*). Drainage was afforded.

Third operation, fifteenth day: Local infiltration anesthesia. A short section of the eighth rib was resected in the posterior axillary line. The underlying pleuræ were found adherent, and an exploratory needle was passed vertically into the rib bed and underlying lung toward the center of the body to a depth of about $2\frac{1}{2}$ inches, where resistance was met and thick yellowish-green pus was withdrawn. A closed hemostatic forceps blade was made to follow the needle and dilate the path to the abscess. The

finger then entered for exploration. A cavity containing 30 c.c. of pus lay between the dome of the diaphragm and the base of the lung (Figs. 138, *c* and 139, *c*). A plain gauze pack, wet with saline, was inserted along the tract, rather than a rubber tube, to afford drainage and protect against air embolism. Bleeding was almost nil.

Bacteriologic examination of the pus obtained at all operations revealed Type I pneumococcus.

The subsequent course was uncomplicated. There was no coughing. Drainage rapidly decreased, although no irrigation

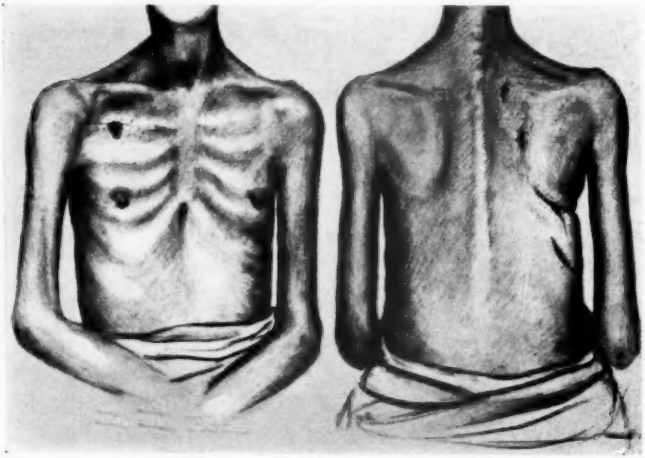

Fig. 141.

was employed, and by the twenty-fourth day all drains were removed. On the thirty-first day the patient was allowed home, the superficial parts of the wounds only being unhealed (Fig. 141).

We have to do in this case with empyema following pneumonia. The history suggests that the pneumonia was of the bronchial type, although Type I pneumococcus is more frequently found in lobar pneumonia. Its course and complication by empyema were not unusual, of course, and the case is presented because of the multiplicity of empyema foci, the rarity of spontaneous extension of infection from acute empyema into

the chest wall, and the use of pneumotomy in draining one of the foci.

If this was bronchopneumonia, we may assume that each of the empyema foci arose as a separate extension to the pleura from an individual pneumonic patch. Walling off and localization of pleural suppuration occur frequently when the pneumococcus is the infecting agent, because of its capacity to produce a fibrinous reaction. If the lung infection had a massive distribution, however, perhaps small cortical abscesses formed and by their rupture were responsible for the separate areas of pleural suppuration.

Surgical drainage of the supradiaphragmatic lesion presented a variation from the usual thoracotomy procedure since the abscess was separated from the chest wall on all sides by lung. The nearest approach was selected, although there was little choice, and pneumotomy was resorted to. To dissect thus through air-containing lung parenchyma, was attended by the danger of opening a pulmonary vein and spontaneous suction of air into the circulation. Air embolism from the pulmonary vein is far more hazardous than from a peripheral vein, for a much smaller amount may be lethal. Danger of air embolism would have been lessened if the actual cautery had been employed to penetrate the lung, but greater destruction of parenchyma would have resulted and the probability of persistent bronchial fistula increased. Air embolism could have been eliminated more ideally by the use of positive pressure breathing during the manipulation, as suggested by Tiegel and employed for this purpose commonly by European thoracic surgeons. As it was, however, there was no sucking of air heard; the lung fistula was the first to close, although it was the last of the wounds to be made.

Spontaneous perforation of an acute empyema into the chest wall is occasionally seen in children and occurs anteriorly with the greatest frequency. The wall is least strongly fortified along the sternal margin owing to the absence of the external intercostal muscle, and the presence of many blood- and lymph-vessels, and nerves perforating the chest wall. Posterior extension is unusual and in the adult, most rare. In acute empy-

ema the passageway leading pus through the chest wall cannot usually be found and the means of transportation is probably by lymphatics. Empyema necessitatis in chronic empyema, on the other hand, presents a definite sinus. In this case it is possible that osteopathic treatments received during pneumonia encouraged spread and localization in the back.

CLINIC OF DR. GEORGE M. CURTIS

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OSTEOCARTILAGINOUS LOOSE BODIES IN THE KNEE-JOINT

Osteocartilaginous loose bodies in the knee-joint originate from three distinct sources. The common form, recently studied by Phemister,[1] arises from the articular surfaces, most frequently from the lateral surface of the medial condyle of the femur. Others originate as osteophytes in the process of an osteo-arthritis by a breaking away of the diseased tissue. The third and rarest variety is formed by proliferative changes in the synovial membrane, in the disease known as synovial osteo-chondromatosis. Jones,[2] who regards the bodies as neoplasms, has reviewed the literature of this condition and has added 19 cases. It is my purpose today to present 3 cases, which I have had under observation during the past year, and which illustrate each of the three different types.

Case I. Osteocartilaginous Loose Body Arising from an Articular Surface.—This active schoolboy of seventeen entered the clinic complaining that his right knee was swollen and that it pained him on any unusual movement. About four years ago he twisted his knee while playing. As he was bending to the side he felt something "slip out of place," and the knee became fixed in position. By manipulation he was soon able to restore normal mobility. But little pain and no noted swelling followed this incident. There was no particular tenderness about the knee, and it remained apparently normal until recently. Two months ago a similar incident recurred while wrestling. This time the pain was more severe and the knee remained fixed for a longer

interval. Subsequently weight bearing was painful, and there was some swelling, however no particular tenderness. He kept off his feet for a week and then wore a firm knee bandage. A third attack of locking followed while he was up and about, and brought him to the hospital.

There was no history of joint disease previous to the onset, or of infectious disease. He had not had tonsillitis. In fact both his past and family history had no direct bearing upon his present condition. Examination revealed a healthy boy with no

Fig. 142.—Case I. Osteocartilaginous loose body from the articular surface of the right knee-joint. The body does not show, owing to the small amount of lime salts which it contained.

particular pathology save a swollen right knee. The joint was moderately distended, and a patellar tap was elicited. There was no limitation of movement, nor pain on movement. There was no localized tenderness, particularly over the menisci, nor any crepitus. No thickening was discerned over the menisci. The loose body was not discovered at this time. His blood-picture was normal; the blood-pressure was 120/80, and the urine was negative. Roentgenograms revealed no evident loose body

(Fig. 142), however there was a slight periostitis along the medial surface of the femoral shaft, just above the epiphyseal line. Vacuoles were evident under the tibial tubercle. The Wassermann and Kahn were both negative.

A diagnosis of traumatic arthritis with effusion was made and about 50 c.c. of thick bloody fluid was aspirated from the joint. No loose body was discovered even after this aspiration, however there was no swelling or particular tenderness over the semilunar cartilages. A light cast was applied for a few days, and then a posterior splint. After three weeks the splint was removed, and there was no marked effusion or stiffness of the joint. Upon using the leg again the effusion returned and two weeks later 90 c.c. of fluid was withdrawn. This was not blood stained. Following this aspiration, the patient insisted that he had felt a loose body, and was able to demonstrate it after considerable manipulation. When finally forced into the upper medial recess of the joint the body was found to be flattened, about the size of a lima bean, and freely movable. The diagnosis thus became evident and excision was advised.

After a rather prolonged manipulation the elusive body was located and held in place just medial to the upper margin of the patella. The overlying skin was infiltrated with $\frac{1}{2}$ per cent. novocain, and the body transfixed with a heavy needle in the usual manner. It was then exposed by a short incision and removed. The joint cavity was not explored. The effusion returned and, nine days later, 120 c.c. of a brownish fluid was aspirated. Convalescence was otherwise uneventful. A second postoperative aspiration was necessary after his discharge from the hospital.

The excised loose body is presented in Fig. 143. The surface shown corresponds to the bony side of the fragmented piece of articular cartilage. It is covered by several irregular scales of bone between 1 and 2 mm. in thickness. These are readily differentiated from the former articular cartilage in the sectioned surface. The cartilaginous surface is irregular and nodular. The margins are smooth and thinner than the central portion which is 4 mm. thick. The freshly removed body measures 15 mm. by

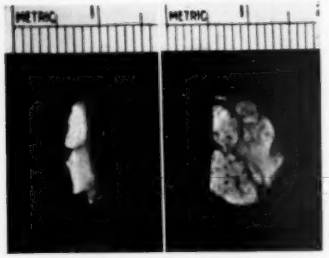

Fig. 143.—Case I. Osteocartilaginous loose body from the articular surface, seen from the bony side and in section. The component bone and cartilage are evident.

Fig. 144.—Case I. Roentgenogram of loose body showing areas of bone and calcification.

Fig. 145.—Case I. Microscopic section of the edge of the loose body. Note the dead bony trabeculæ (A) covered by a fibrous membrane. At the margin there is fibrosis and fibrocartilage.

16 mm. A roentgenogram of the entire body (Fig. 144) reveals the remains of bone, and the calcification. Trabeculæ are visible on careful examination.

Microscopically, the greater part of a transverse section of the body (Fig. 145) is composed of hyalin cartilage. The matrix is increased in amount and stains unevenly. There is irregular diffuse calcification. The cells appear to have been alive. There is some fibrosis and, particularly about the margins, some fibrocartilage. On one side are found trabeculæ of dead bone. Between these trabeculæ are fibrous connective tissue and fibrocartilage. The surface is covered by a fibrous membrane with marked flattening of the superficial cells. The diagnosis is thus warranted of an old osteocartilaginous loose body, originating from an articular surface, and composed mainly of cartilage.

At the time the first and second aspirations were made, 6 mg. of phenolsulphonephthalein was injected into the joint cavity through the aspirating needle. It appeared through a bladder catheter in twelve and a half minutes in both instances, and about 45 per cent. was excreted during a two hour period. This indicates a good absorptive power of the synovial membrane. We have had the same experience in two other cases of traumatic arthritis with effusion. A study of the chemistry of the joint fluid, and in one instance whole blood drawn at the time of aspiration, was made. The results are presented in Table 1. The sugar values are slightly low, but not so low as those reported by Allison[3] in cases of infectious arthritis of gonococcus, streptococcus, or tuberculous origin. The chlorid values are higher than

TABLE 1

CHEMISTRY OF THE JOINT FLUID

Fluid and date.	Sodium chlorid, mg. per cent.	Sugar, mg. per cent.	Urea, mg. per cent.	Non-protein nitrogen, mg. per cent.	Specific gravity.	Remarks.
Bloody effusion. 6/6/28	733	95	16	35	1.0186	First aspiration after locking. 50 c.c. withdrawn.
Blood. 6/6/28	534	103	15	32	1.055	Whole blood drawn at time joint was aspirated.
Effusion. 7/11/28	627	85	14	28	1.0167	Preoperative — eight days. 90 c.c. withdrawn.
Effusion. 7/28/28	591	81	15	32	1.0146	Postoperative — nine days. 120 c.c. withdrawn.

those of the blood, while total nitrogen determinations indicated a lower protein content in the effusion than in the blood. This is the usual finding in effusions. The specific gravity is definitely lower than that of the blood, which averages 1.055. Our results are too incomplete as yet to lay stress on them as a diagnostic measure. The synovial membrane, however, must be freely permeable to crystalloids.

The difficulty of diagnosing this case lay in the character of the loose body, which was doubtless separated by an earlier trauma from the articular surface. It was mainly cartilage, with mere scales of the underlying bone. It was not dense enough to yield a discernible shadow through the tissues of the knee, which is unusual. Osteocartilaginous loose bodies nearly always cast a shadow in the *x*-ray. However, it did when removed. There was no history of previous infection, and its origin is, in all probability, traumatic. Its relation to the so-called "osteochondritis dissecans" is problematic with the evidence at hand. The aspirated fluid was sterile bacteriologically, and negative when injected into guinea-pigs.

Case II. Osteocartilaginous Loose Body Arising as an Osteophyte in Chronic Osteoarthritis.—This active man of sixty-nine came to the clinic complaining of pain and locking of his left knee. At times he had also noted a readily palpable, movable body in the joint. During his earlier life as a sailor he was often exposed to the elements, and for many years has suffered from chronic arthritis. This has never been severe enough to disable him. About six years ago the left knee became particularly affected, and was painful and tender after walking. There was no associated swelling, or no particular discomfort at rest. A little over a year ago locking first occurred. There was no recognized trauma preceding the first attack. Locking has since become more frequent, and the resulting pain and disability have forced him to give up his work, and come to the hospital for treatment.

Outside of the arthritis he has always been unusually well. He is deaf on the right side. Years ago he had two rather severe

falls, but neither resulted in injuries to the knee. Venereal disease is denied and the Wassermann and Kahn are both negative. He has five healthy children. His past and family histories are otherwise irrelevant.

Examination revealed a somewhat undernourished man who did not appear to be sixty-nine. He walked with a limp, favoring his left leg and using a cane. The pupils were negative. His tonsils were enlarged and his teeth in poor condition. There was no particular pathology save in the left knee. This was painful

Fig. 146.—Case II. Osteocartilaginous loose body formed in the course of a chronic osteoarthritis.

on motion, and crepitus was readily elicited by moving the patella. A nodular, movable loose body was palpable medial to the upper end of the patella. There was no swelling of the joint, and but very little if any effusion. Hyperextension with tensing of the quadriceps tendon, or more than 80 degrees of flexion caused pain in the region medial to the patella.

His blood-picture was negative, however his blood-pressure was 205/110. The urine was negative. Roentgenograms of the knee (Fig. 146) revealed a diminution in width of the inter-

articular space, particularly medially, irregularity of the articular surfaces, osteophyte production, and a loose body between the patella and the lower part of the shaft of the femur. From the films the roentgenologist considered the possibility of an early Charcot joint. The Wassermann and Kahn were consequently repeated, again with negative results. There was no discernible clinical evidence of lues. A diagnosis of loose body resulting from the separation of an osteophyte in chronic osteoarthritis was thus made and operation advised.

To localize the loose body accurately a roentgenogram was made just before operation and the knee left immobilized. Under novocain infiltration anesthesia an incision was made over the palpable body, medial to the patella and along the quadriceps

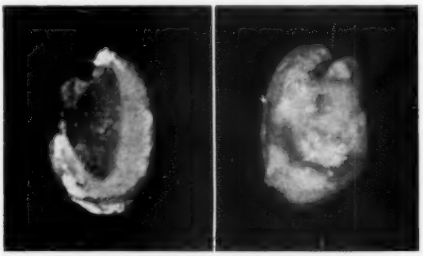

Fig. 147.—Case II. Osteocartilaginous loose body originating as an osteophyte in osteoarthritis. The calcification in the cartilage is evident, and in the transverse section, the osseous center.

tendon. The nodular, cartilaginous body was then exposed, lying just medial to the upper end of the patella. It was attached to the thickened and villous synovial membrane by a short vascular pedicle. Excision was followed by ligation of the pedicle. The joint was but slightly sensitive to exploratory palpation. Articular cartilage has no recognized nerve-supply. Numerous nodular, cartilage covered osteophytes were evident, particularly along the margin of the tibia, and the edge of the patella. These were not removed. There was no evidence of a recently separated osteophyte. The wound was closed in layers. Save for the accumulation of fluid in the joint he made an uneventful recovery and was dismissed on the eleventh day wearing a posterior splint.

On the seventh day 30 c.c. of rather thick, straw-colored fluid was aspirated from the joint. This was sterile bacteriologically. A Wassermann made on this fluid was also negative.

The excised loose body (Fig. 147) is ovoid in shape and measures 20 x 13 x 10 mm. Its surface is firm and nodular. The vascular pedicle was attached at the cleft visible in the upper margin. At this point but little cartilage covers the underlying bone. The irregular areas of calcification within the surrounding cartilage are evident as white plaques in both views. The osseous center is rather sharply demarcated. Roentgenograms (Fig. 148) reveal that the calcification is irregular and largely in the periphery of the cartilage. A distinct zone of calcification separates cartilage and bone.

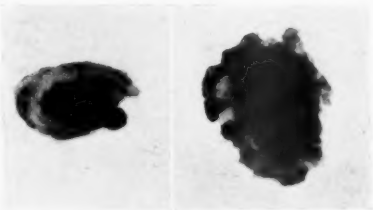

Fig. 148.—Case II. Roentgenograms of the entire loose body and of a transverse section. Note the irregular calcification within the cartilage and the osseous core.

Microscopically (Fig. 149) the body is covered by a thick cartilage largely hyalin in character. The surface cells are flattened, in places resembling a dense fibrous membrane. There are numerous cartilage cells. The matrix is irregularly calcified and stains unevenly. Some fibrocartilage is present. Between this layer of cartilage and the central bone is a heavily calcified layer of very cellular cartilage. This resembles in some respects, the calcified zone in epiphyseal cartilage in endochondral bone formation. There is an irregular layer of cellular hyalin cartilage under the calcified layer (Fig. 149, D). The central portion is composed of necrotic bone. Trabeculæ and even lamellæ are evident, but no bone-cells. The spaces are filled with fat and loose fibrous tissue and contain but few cells.

The origin of this loose body seems reasonably established. There is an evident osteoarthritis of the hypertrophic variety in the knee-joint, with a rather definite history behind it. Numerous osteophytes and osteophyte production are evident roentgenologically, and were actually observed at operation. The loose body evidently broke away some time previously and then became reattached to the synovial membrane. Phemister[1] has found experimentally that this occurs when free pieces of carti-

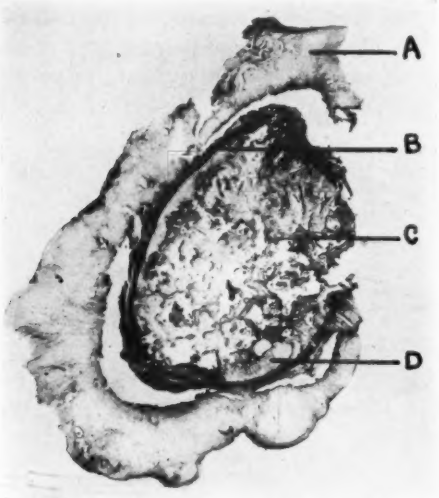

Fig. 149.—Case II. Microscopic section of the loose body: *A*, Hyaline cartilage; *B*, heavily calcified cellular cartilage; *C*, bone trabeculæ; *D*, cartilage.

lage or cartilage and bone are detached into normal joints. There is no evidence to warrant regarding the knee as a Charcot joint. However, a spinal puncture was not made.

Case III. Osteochondromatosis of the Left Knee-joint.—This woman of fifty-seven complained of pain, and rather moderate symptoms indicating locking of the left knee-joint. At the age of fifteen she had acute articular rheumatism, accompanied by fever, pain, and swelling of the joints. For many years she has had chronic arthritis, noted particularly in the left knee.

Our attention was called to this while she was a patient in the hospital under treatment for constipation and hemorrhoids. A roentgenogram of the knee (Fig. 150) revealed the characteristic picture of multiple osteochondromata of the joint.

She had a number of infectious diseases previous to the onset of the arthritis—measles, scarlet fever, with renal involvement, and about twenty-five years ago her tonsils were removed. One aunt had tuberculosis. She has recently lost weight owing to an insufficient diet instituted to overcome the abdominal distress

Fig. 150.—Case III. Osteochondromatosis of the knee-joint.

associated with chronic constipation. Her past and family history are otherwise without direct bearing upon her condition. Examination reveals a sallow, nervous woman who is somewhat undernourished. The left knee is not swollen. There is some pain on movement and definite crepitus is elicited by palpation. There are arthritic changes in the phalangeal joints. She has a mitral insufficiency, well compensated, doubtless from old rheumatic, mitral valvular disease. The electrocardiogram shows left ventricular preponderance and no arhythmia.

The blood-picture is normal. The Wassermann and Kahn are both negative. The urine shows some albumin, a moderate number of leukocytes, and a few hyalin casts. The stools contain mucus, but no blood or pus. By orthodiagram the heart is 32 per cent. oversize. Her basal metabolic rate is +6. Roentgenograms reveal multiple shadows cast by loose bodies in both compartments of the knee-joint (Fig. 150). An hypertrophic arthritis of the joint is evident. There are exostoses of the patellar margins, of the head of the tibia, and of the posterior surface of the femur at the junction of the shaft and condyles. There is also hypertrophic arthritis of the spine, with definite exostoses of the margins of the vertebral bodies, particularly in the lumbar region. A diagnosis of osteochondromata of the knee-joint associated with osteoarthritis was made, and operation advised.

Under ethylene anesthesia a median longitudinal incision was made over the patella. The quadriceps tendon and patellar ligament were split and the patella sawn in two, exposing the joint cavity. About fifteen osteochondromata were attached to the synovial membrane, particularly in the lateral superior recess of the joint cavity. They were excised together with the thickened and villous synovial membrane (Fig. 151). Four bodies were removed from the lower medial portion of the joint, and four which lay in the space between the medial condyle anteriorly and the margin of the tibia. The majority of these latter bodies were free and without pedicles. The joint was flooded with formol-glycerin-iodoform mixture, and the excess sponged out. The quadriceps tendon and fascia covering the patella and patellar ligament were then closed with interrupted chromic catgut. The skin was closed with interrupted black silk. The patient was then turned and a median longitudinal incision made over the popliteal space, which was entered. The contents were retracted laterally and the capsule of the joint exposed. It was incised and about a dozen bodies removed, four of which were moderately enlarged and firmly attached to the synovial membrane. The latter were located, and removed by incising directly over them. The synovial membrane and capsule were closed with catgut, the fascia with catgut, and the skin with black silk. Convales-

cence was uneventful. No postoperative effusion occurred, and it was not necessary to consider aspiration of the joint. There was some drainage from the lower angle of the anterior wound, otherwise healing was *per primam*. Four and a half months later there was no swelling or tenderness in the joint, which could be completely extended. Flexion was limited to little beyond a right angle. She stated that the left knee was now stronger than the unoperated knee, and definitely improved.

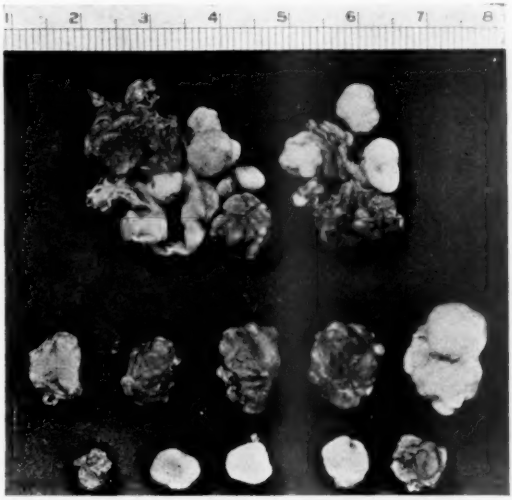

Fig. 151.—Case III. Osteochondromata removed from the knee-joint. Those above are attached to excised synovial membrane by pedicles.

The freshly excised synovial membrane was thickened, but soft and pink in color. It was folded and covered by numerous irregular villi. In one piece the bodies are small, from 1 to 3 mm. in diameter, and embedded within the lining membrane without pedicles. In two other pieces (Fig. 151) the bodies are larger, more ovoid, and from 2 to 9 mm. in diameter. One has eight, the other seven attached osteochondromata. The pedicles vary in length and thickness. There is a definite series indicating that as the body grows the pedicle becomes lengthened and often

attenuated. It is in this manner that the bodies break away and become true corpora libera. In addition there are 16 bodies varying from 3 to 17 mm. in diameter. The larger of these are presented in Figure 151. Seven were true corpora libera within the joint cavity. Nine were more or less attached to the lining membrane. The bodies are all irregularly nodular and have cartilage covered surfaces. Thirty-five bodies in all were determined in the tissue removed, and of these, 80 per cent. were attached to the synovial membrane. When sectioned the bodies contain varying amounts of bone and calcified tissue, but are

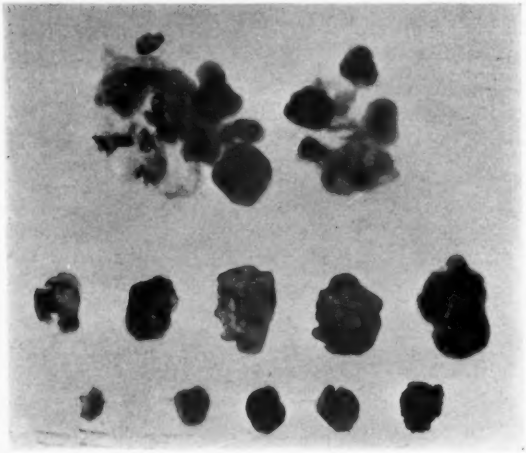

Fig. 152.—Case III. Roentgenogram of loose bodies arranged as in Fig. 151, actual size. Note the irregularity of calcification and bone formation.

uniformly covered with cartilage. Certain of the smaller bodies are entirely cartilaginous.

The varying degrees of calcification, as well as the presence of osseous trabeculæ, are presented in the roentgenogram (Fig. 152). This is taken with the bodies arranged in the same position as in Fig. 151. The pedicles contain no calcified material, likewise certain of the smaller bodies present no shadows.

Figure 153 presents a section of the synovial membrane in the region of the attached osteochondromata. The membrane is

thickened and there are numerous villi. The villi are covered by one or more layers of polyhedral cells, and are made up of a loose fibrous tissue with many blood-vessels. There is a rather extensive infiltration of lymphocytes in many of the villi, and aggregations, particularly around the blood-vessels. The two layers of the thickened synovial membrane are evident, the inner being fibrosed. The underlying fibrous tissue is well vascularized. From the section a diagnosis of chronic villous synovitis is warranted.

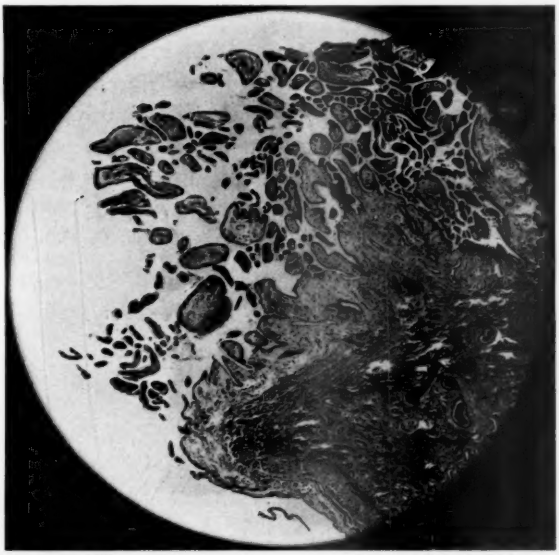

Fig. 153.—Case III. Chronic villous synovitis associated with osteochondromatosis of the knee-joint.

Four theories have been advanced to account for the origin of joint osteochondromata—the infectious, traumatic, embryologic, and neoplastic. These are discussed by Jones,[2] who favors the part played by trauma and regards the bodies as neoplasms. In this case the evidence at hand favors the infectious theory. The early acute articular rheumatism, the infectious diseases with a subsequent osteoarthritis, and the evident chronic villous

synovitis furnish a definite infectious basis preceding and associated with the development of the osteochondromata. As a consequence we are more inclined to favor the infectious theory in this particular case. Fisher[4] has divided the disease into cases with and without an associated osteoarthritis. In reported cases without arthritis or synovitis it is admittedly difficult to lay the origin of the bodies to infection.

The treatment of osteocartilaginous loose bodies in the knee-joint is uniformly arthrotomy and excision. The results of operation are as a rule good. The exposure of the joint obtained by splitting the patella is excellent. In cases of multiple osteochondromata, all the bodies should be removed. The prognosis is good. Osteochondromata are not likely to recur if completely removed. The subsequent relief from the often disabling symptoms is most gratifying. It followed in all 3 cases. In Case II, with an associated chronic osteoarthritis of severe degree, there was still some pain and stiffness in the knee five months after operation. However, there was no recurrence of the disabling locking and its sequelæ.

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CLINIC OF DR. FRANCIS HOWE STRAUS

PRESBYTERIAN HOSPITAL

POSTPNEUMONIC EMPYEMA. PNEUMOTHORAX FROM ASPIRATION

THE first case I am presenting to you has been under the care of Dr. Walter Hoffmann. It is an eleven-month-old girl, whom he has watched as she progressed through a severe bronchopneumonia. Two weeks ago he detected physical signs of fluid in the right pleural cavity which were confirmed by *x*-ray study. Coincidentally the temperature, which was already high, became higher and the child became very acutely ill.

The child was brought to the hospital at that time. There were coarse râles over all of both lungs. The rate of respiration was very high, and there was a persistent cough. In talking over the case then we both agreed that the clinical picture and findings were definitely those of an emypema following a bronchopneumonia, and that we had every reason to believe the pneumonic process was not yet over.

In view of this fact it seemed definitely indicated that open drainage of the empyema be avoided at that time. Accordingly, under local anesthesia, an aspirating needle was introduced into the right pleural cavity in the eighth interspace posteriorly. This was mounted upon a 20 c.c. syringe equipped with a two-way valve between syringe and needle. About 6 ounces of thin gray pus had been removed, when air began to come through the needle instead of pus. I believed that there was a leak in the syringe-needle connection and stopped the aspiration. Fluoroscopy immediately afterward showed most of the fluid had been removed, but also showed a large bubble of air escaping the upper part of the pleural cavity. I was considerably disturbed by this, and was still more inclined to blame the syringe. How-

ever, the temperature came down and there seemed no marked respiratory embarrassment. Two days later the temperature began to rise and on the third day I again aspirated the chest, but this time in the ninth space. After several ounces of pus had been removed, I again began to pump out air, and removed a great many syringe barrels full of it without appreciably decreasing the gas tension within the cavity. I had tested the tightness of the valves before I began the aspiration, and the explanation began to become evident. I think there is no doubt that the pneumothorax is due to a communication between the lung tissue and the pleural cavity. As it was not apparent before the first aspiration and was demonstrated to have occurred immediately thereafter, the presumption is that the aspirating needle tore through lung tissue and established an air-passage.

x-Rays taken after the second aspiration showed the right lung collapsed with the exception of a narrow band of tissue passing from the hilus to the lower middle portion of the chest wall. It is very possible that here, where the lung is held by adhesions against the parietal pleura, is where the needle injured it. Another hypothesis is tenable; the lung tissue was stiffened and rigid because of pneumonic process. The visceral pleura was softened by its infection. Air pressure within the lung was in equilibrium with fluid pressure without. When the fluid volume was decreased by aspiration, the atmospheric pressure within the lung tended to force it out into the relative vacuum; but instead, a weakened alveolar-pleural sac gave way and the pneumothorax resulted.

At any rate there seems no doubt that an internal, open pneumothorax exists, as I could yesterday aspirate unlimited amounts of air from the thorax. You will recall that I previously stated that open thoracotomy and drainage were to be avoided in this patient. The reason is clear. We had a patient already breathing very rapidly in the effort to bring as much air as possible in contact with what alveolar surface was not rendered ineffective by an extensive pneumonic process. Her tidal air requirements—the air inflow and outflow necessary to maintain life—seemed to be all that her respiratory efforts were capable of

meeting. There was no margin of safety with which to meet either an increased demand for or a reduced supply of air. If we then instituted pleural drainage, the open pneumothorax causing a partial collapse of the lungs would further reduce the aëration of still functioning alveolar surface, and possibly to a point below that necessary to maintain life. It might be more clear if I rephrased this, and said that the bellows action of her thorax sucked in and blew out from her alveoli just enough air to meet her requirements, and we then proposed altering conditions so that a portion of the air thus sucked in and blown out did not reach alveolar surface. An opening in the thorax and partial collapse of the lungs does not mean that the amount of air entering the thorax is diminished. With the same excursion of diaphragm and ribs, the total flow of air will remain constant. But, dependent on the size of the new opening, a certain part of the air-flow will now reach pleural surface through the thoracic wall, and by just that volume of air will the alveolar ventilation be diminished. The volume of air that flows through the thoracotomy must be compensated for by increased range of motion of the respiratory muscles to take in still enough air to ventilate the alveoli, which means increased muscular effort from an already exhausted patient. Or, if the full range and rate of respiratory effort are already being used, it means asphyxia. For these reasons we delay open drainage in empyema cases until the respiratory embarrassment of the pneumonia is passed. And another argument for delay lies in the inflammatory process itself. During the first few days of an empyema the visceral and parietal pleuræ adhere at the margins of the process. The adhesions become firmer and begin to organize. The mediastinal pleura becomes thicker and less mobile; so that if, after this period, a thoracic opening is made, very little further collapse of lung occurs. The air that flows in and out of the new opening is now limited by the size and mobility of the walled-off empyema sac, and not by the size of the opening.

I had in this case hoped to utilize these factors of safety and continue periodic aspirations until I felt sure that thoracotomy was safe. However, the first aspiration subjected the patient to

the test of an open pneumothorax without fatality. It is possible that the opening I am about to make will be larger than that, but in the meantime five days have passed during which the pneumonia has been subsiding, and adhesions forming to limit any further collapse of the lung.

I have infiltrated an area 1 inch long in the ninth interspace below the scapula. I am making an incision through this, midway between the ribs, which I carry directly through the muscles and the pleura. There is scarcely any bleeding. With a hemostat I can easily separate the ribs to insert two No. 20 rubber tubes. The ribs in infants and children are so easily spread that we never find it necessary to resect them in order to insert tubes of this size. I might mention that I am using red rubber tubes for the red iron oxid pigment makes them opaque to *x*-rays. This is very reassuring if a tube and its safety pin disappears in the dressings, and there is any doubt as to its presence in the cavity. Some, but not all, black rubber is opaque to *x*-rays, and unless this opacity has previously been determined, I prefer the red variety.

There has been no disturbance of pulse or respiration. The tubes are sucking in and blowing out a little air, but so little that I feel sure no further collapse of sound lung has occurred. With each expiration pus and air are being ejected. The tubes will be maintained in their position until the absence of discharge and lipiodol injections through them show that the cavity has been obliterated by expanding lung.

INTERLOBAR EMPYEMA FROM KNIFE WOUND. DRAINAGE

THE next patient is a colored woman of twenty-six. She has been married and had one child. Her past history is essentially negative. She is separated from her husband, and three weeks ago she attended a dance. There was a brawl, and in the fighting she was stabbed in the right chest. She did not seem badly hurt, and was held in a police station until the next day. She was allowed to go home, where she remained for two days. Then she began to feel sick, and applied for admission to a hospital. She was told there that she had a high fever, but she complains that nothing was done for her in the way of diagnosis or treatment; so ten days ago she left and came to the Presbyterian Hospital.

At the time of her admission her temperature was 103° F., her pulse was 100, and respirations 36. The leukocyte count was 16,200. With the exception of the chest, physical examination was negative. Under the angle of the right scapula in the ninth interspace was a clean-cut, partly healed, perforating stab wound from which purulent fluid was slowly oozing. There was marked dulness to percussion over the back of the right thorax to the level of the fifth interspace. The vocal fremitus was absent over the same area, and voice-sounds were diminished. A few fine crackling râles were heard, and the records show the breath-sounds were reported as tubular. The right upper chest and the entire left lung showed essentially negative findings. The heart was not demonstrably displaced and showed no evidence of abnormality.

It was obvious at that time that we were dealing with a suppurative pleuritis the result of a neglected stab wound through the wall of the thorax. Fortunately the slit-like wound had acted as a fairly effective valve that had permitted egress of pus, but prevented the entrance of air. The length of time since the onset of the infection seemed adequate guarantee of efficient visceroparietal adhesions at the margins of the empyema to pre-

vent further collapse of the lung. The patient's general condition showed that her spontaneous drainage was inadequate. So, at the time of the first examination, two No. 20 (French) catheters were pushed into the pleural space through the existing stab wound. A considerable increase in the amount of drainage followed this, but the patient's general condition did not improve. The temperature, pulse, and respiration varied about the level of the first figures.

Stereoscopic *x*-rays taken the next day showed the changes of pleuritis with some fluid still present in the posterior portion of the right thoracic cavity. There was also a dense shadow with ill-defined margins at the level of the seventh interspace posteriorly. This seemed in the stereoscope to be well separated from both the anterior and posterior ribs. It was interpreted as possibly indicating an encapsulated abscess in the interlobar fissure.

The patient's temperature continued a high, irregular course. The leukocyte count rose to 26,000. The drainage from the tubes in the stab wound seemed free, and it became evident that the interlobar abscess required drainage. An effort was made to reach this with an aspirating needle three days ago without success, and I intend to try to find it today.

In this patient, in contradistinction to the last one, the long-standing infection of the pleura insures me against collapse of the lung. The visceral and parietal pleura for some distance about the process will be thickened and fused so that if I find the abscess, there will be no risk of spreading the infection to other pleural surfaces. I intend to work through the area of pleural adhesions to utilize this.

The right side has been cleaned. She is lying partly prone and on her left side, with her shoulders slightly lower than her hips. This position, as suggested by Van Allen, is preferable where a large needle is to be passed, possibly through lung tissue. If a neighboring vein and bronchus are wounded, air may be forced into the circulation. With the shoulders elevated the arch of the aorta acts as an air-trap and the air-bubble is much more likely to enter the innominate or carotid. This is much less

likely to occur when the patient is placed so these vessels do not lie at the top where the lighter air-bubbles will enter them. If such an embolism occurs, I should much prefer that it lodge in some other organ than the brain.

With a fine needle I inject novocain in the seventh interspace just below the scapula until I feel the pleura with the needle

Fig. 154.—Drawing with needle *in situ* and grooved director being passed along it.

point. I follow this tract with a long large needle mounted on a syringe. I am pointing the needle directly forward and slightly laterally in the direction of the shadow seen in the film. I can

feel the needle pass the thickened pleura. I am pulling on the plunger of the syringe as the needle progresses. The needle has now penetrated about 4 inches, and I am sucking thick pus into the syringe. I shall not aspirate much of this, as I wish to introduce a tube into the abscess, and would like, at this long range, to have my target as large as possible.

I have unscrewed the syringe, leaving the needle in place as a guide. Infiltrating a space of 3 inches, with the needle in the center, I am resecting about 2 inches of the eighth rib subperiosteally. Unlike the infant's, this adult's ribs are wide and close together, and cannot be spread sufficiently to work between them in a small incision. As I approach the pleura I do not see the visceral pleura of the lung gliding against it, and I know that my assumption that the space was obliterated can be relied upon. But I verify this by incising through the parietal layer before proceeding. I now pass a long grooved director along the needle, following it by tactile sensation, until I feel the needle point lodged in the beginning of the groove. The needle is withdrawn. I can now pass a narrow, long straight hemostat down the groove in the director, again guiding it by tactile sensation, until it reaches the end. As I open the jaws of the hemostat and dilate the tract, a gush of pus occurs. I now measure with the needle a length of our largest size catheter, and add $\frac{1}{2}$ inch to the measurement. I can easily push the tube its measured distance along the director in the tract made by the hemostat, and then remove the director. Pus is flowing from the tube. With two silkworm-gut sutures the skin incision is very loosely drawn together on each side of the tube.

VICIOUS CIRCLE OF COLON FROM ILEOSIGMOIDOSTOMY

THE last patient I shall show you is a woman of thirty-six. She was operated upon for a "twist of the intestines" twelve years ago, and she dates her difficulties from that time. She was not acutely ill at the time of the operation, but for some weeks had been suffering from abdominal cramps. She consulted a physician in another city and was advised to undergo an operation. The operation was performed, but she does not know what was done. She made an uneventful recovery, and left the hospital three weeks later. But ever since then she has suffered from severe constipation. It is not unusual for her to go more than a week without a stool, and when a stool is passed spontaneously, it is composed of only a few small dried balls of fecal material. Enemas return with only a little feces, but she has relied on enemata every three to four days to obtain what relief she can. Concomitantly with the constipation, she began to have dull headaches much of the time. There has been no abdominal pain, and the history is otherwise insignificant. She has consulted a number of physicians, and has attempted various types of anticonstipation diet and catharsis without relief.

Physical examination shows her, as you see, to be a very thin, sallow woman. But nothing is found that is at all suggestive of abnormality save the healed midline operation cicatrix. The routine laboratory findings are normal with the exception of stool examination which we have not been able to obtain. The fluoroscopic study of the colon was, however, very interesting and, I believe, explains the condition.

Yesterday she was given a barium enema. The rectum filled readily to normal size, and, in turn, the sigmoid, the descending, transverse, and ascending portions of the colon and the cecum filled. These all seemed entirely normal in outline, situation, and mobility. But after the colon was filled and further influx of barium suspension was stopped, a very interesting picture de-

veloped. Very active motions of the entire colon began and large masses of opaque suspension were pushed from the cecal toward the sigmoid end. The cecum emptied itself, and then a short narrow column of suspension could be seen passing from sigmoid to cecum, and refilling it. In location and relations this seemed to be the terminal portion of the ileum with its normal opening into the cecum and an accessory opening from the sigmoid. During the few minutes we watched the process, the contents of the colon made the entire circuit twice.

It seems clear that we are here dealing with an ileosigmoidostomy. I am not able to say why the original operation was per-

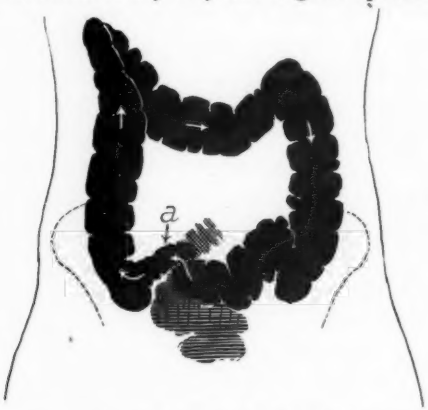

Fig. 155.—Diagram of vicious circle with indicating arrows.

formed, but at present there is no evidence of abnormality or obstruction of the colon between the cecum and sigmoid. It also seems clear that the changed relationship has brought about a vicious circle so that the colon continually re-empties itself into its proximal portion through the terminal ileum; and it is only occasionally that fecal material escapes from the circle and passes into the rectum. The fact that the ileum did not fill when the enema passed upward in the sigmoid from the rectum, and still so completely intercepts the downward stream from peristalsis, suggests to me a possible valve-like flap at the lower margin of the stoma, but this is hypothetic. This seems still more likely

when we recall that intestinal peristalsis almost always will push intestinal contents through their normal channels regardless of accessory stomata when the normal channels are open.

I have told the patient that the only relief for her constipation that I can suggest would be to undo the ileosigmoid connection by operation.

CLINIC OF DR. ROBERT H. HERBST

PRESBYTERIAN HOSTITAL

HEMATURIA: CASE REPORTS WHICH EMPHASIZE THE SIGNIFICANCE OF THIS CLINICAL SIGN

THERE is probably no one sign in the realm of urological diagnosis of greater value than hematuria. The presence of blood in the urine, whether in macroscopic or microscopic quantity, is so frequently the first and often the only sign of pathological change in the urinary and genital tracts that its recognition and the determination of its cause should receive the utmost limit of our investigative effort.

Procrastination in determining the location and cause of such bleeding will usually result in the progression of the pathological process from one which may have been simple and readily amenable to treatment, to one which may cause the loss of an organ like the kidney or even the life of the patient. Therefore, the expectant treatment of this danger sign can be followed only by clinical failure on the part of the physician, and loss of much valuable time by the patient.

It is startling to lock through one's records and find case after case giving a history of hematuria of months' and years' duration in which little or no investigation had been carried out to determine the cause of the bleeding. Many patients, having received various forms of treatment such as vaccines, bladder irrigations, and internal medication, were found to be suffering from serious pathology in the kidney, bladder, prostate gland, or urethra.

In the investigation of the patient our problem is twofold: first, to locate if possible the source of the bleeding and, second, to determine the nature of the pathological condition which may be the cause of it.

Beginning at the urethra I am going to mention some of the conditions of the urinary tract and lower end of the genital tract which may cause blood to appear in the voided urine. In the urethra may be mentioned granulations; benign and malignant neoplasms, such as polypi, papillomata, caruncle, and cancer; foreign bodies including stone; gonorrheal and other infections including chancroid, chancre, and herpes; stricture; fistulæ; diverticula; and trauma. In the prostate gland may be considered benign and malignant tumors of which the most important are adenoma and cancer; infections, including tuberculosis; and stones. In the seminal vesicles may be mentioned stones and infections, particularly acute empyema. In the bladder may be enumerated tumors, stone, infections, including secondary tuberculosis from the kidney or genital tract, diverticulum, bilharzia, ulcers, purpura, acute hemorrhagic cystitis, rarely syphilomata, trauma, rupture, angiomata, varicosities, fistulæ opening into the bladder, stone in the ureter, neoplasms, ureteritis, and stricture. Pathology in neighboring organs may produce hematuria, such as appendicitis and pelvic abscess. In the kidney and renal pelvis may be mentioned tumors, both solid and cystic; infections, including tuberculosis and syphilis; calculi; hydro- and pyo-nephrosis; various forms of nephritis, including the arteriosclerotic kidney, perinephritis, and perinephritic abscess opening into the renal pelvis; embolism, thrombosis, and aneurysm of the renal vessels; angioma of the papillæ; and movable kidney. Also systemic conditions such as purpura hemorrhagica, hemophilia, scurvy, and leukemia may cause hematuria.

Although this list is not complete, it serves to emphasize the importance of the careful study of patients in whom red blood-cells are found in the urine. I am not going to take time to describe in detail the diagnoses of these various conditions, but I wish to outline in a rather general way the course to pursue in the investigation of a case of hematuria, with or without other signs and symptoms which may point to the location and cause of the bleeding.

A complete history of the case and a carefully carried out

general physical examination may give information helpful in demonstrating the cause of the hematuria. By this examination one may find foci of infection, tuberculosis of the lung and bronchial glands, or arteriosclerosis with high blood-pressure. Palpation of the upper abdomen may reveal enlargement or malposition of one or both kidneys. In palpation of the suprapubic region a large mass may at times be felt in the bladder as in cases of large stone, diverticulum, or tumor. Palpation of the scrotum may reveal changes pointing to associated lesions in the urinary tract, such as tuberculosis. Examination of the rectum, including palpation of the prostate gland and seminal vesicles, may give evidence of infection or neoplasms developing in these organs.

The two- or three-glass test will aid in locating the origin of blood coming from the lower urinary tract. Blood appearing at the meatus of the urethra independent of the act of urination usually has its origin in the anterior urethra. This is also the case when blood is found in the first glass and the second is clear. When both glasses are soiled its origin may be in the posterior urethra, the bladder, or upper urinary tract. Terminal hematuria is usually significant of a lesion of the neck or interior of the bladder, the blood being forced from a tumor or ulcer by the contraction of the bladder wall at the end of the urinary act.

A plain *x*-ray film of the urinary tract may reveal the presence of a stone in the kidney, ureter, bladder, or prostate gland; or a change in the shape, size, or position of one or both kidneys.

Study of the voided urine—chemical, microscopical, and bacteriological—may give evidence of a nephritis, an infection of the genito-urinary tract, or of the presence of tumor cells.

A Wassermann blood test, if positive, may help in directing our attention to the cause of the bleeding.

A urethroscopic examination will aid in finding lesions of the urethra, such as strictures, granulations, neoplasms, and ulcers.

The next step in this study is the cystoscopic examination which may show the presence of a tumor, stone, or other foreign body; diverticulum; ulcers; tuberculosis (secondary to renal or genital tract tuberculosis); changes in the prostate gland; or one

of the less frequent lesions, such as the vegetations produced by bilharzia. Catheterization of the ureter may bring out the presence of an obstruction in the ureter. A study of the collected urine from each kidney may aid in disclosing an infection of one or both kidneys such as tuberculosis or an unilateral nephritis. Or, if tumor cells are found in the urine, the type of neoplasm as well as its location may be determined. The injection of phenol-sulphonephthalein and the determination of the output of dye from each kidney may be helpful in the diagnosis. Injection of the kidney pelves with a contrast fluid such as sodium iodid and the taking of an *x*-ray film of kidneys and ureters (pyelo-ureterogram) may show the presence of a tumor of the kidney, pelvis, or ureter, help to bring out the shadow of a calculus in the kidney or ureter which failed to show in the plain film, reveal a stricture or kink in the ureter or dilatation of the pelves and calices (hydronephrosis). The pyelogram may show an anomaly of the kidneys or ureters or a malposition of these organs which may be the cause of the hematuria.

I have gone into rather minute detail in the description of a method of procedure to determine the location and cause of hematuria in a given case for two reasons: First, to show that an orderly painstaking examination of the patient will give the highest percentage of correct diagnoses; and second, that a fair part of these examinations can be carried out by one who is not especially trained in urologic diagnosis. All of the study up to the point where the urethroscope is used can be carried out by anyone who will use his hands and his eyes coupled with a moderate ability in laboratory technic. A fairly large percentage of cases showing blood in the urine may be diagnosed in this way, and, although it may be necessary to use some of the more refined urologic diagnostic methods to clarify some of them, a routine study of all patients showing red blood-cells in the urine is certain to aid in bringing more of these cases to early treatment, which in turn is bound to reduce suffering, save organs, and lower the mortality in lesions of the genito-urinary tract.

If one reviews the pathological conditions which may cause

hematuria he is bound to realize that most of them progress with time since few are innocent, and that an early diagnosis in many instances offers the only hope of control or cure. Tumors of the kidney and bladder, renal tuberculosis, and calculus are striking examples of this, and we know that the only sign which they may give for months and years is an intermittent painless hematuria. Idiopathic or essential renal hematuria is a diagnosis which is rapidly disappearing from case records, and although there are instances in which a definite pathological change cannot be demonstrated as the cause of the bleeding, a painstaking careful study in which all of our modern diagnostic methods are utilized is certain to place this form of diagnosis among the unusual. I am going to present 4 cases, each one being a striking example of the failure to follow up the sign hematuria when first seen. In each of these cases the result might have been better had the diagnosis been made when the blood first appeared in the urine.

I will present a case of tumor of the kidney, renal tuberculosis, tumor of the bladder, and renal calculus.

It is in these conditions more than all others that we are helpless unless the case is diagnosed and brought to operation early, and hematuria is often the warning signal.

Case I. Tumor of the Kidney.—A male aged fifty-six years on admission to the hospital complained of intermittent attacks of hematuria dating back about eight months. The last of these attacks was accompanied by pain in the left flank, frequency of urination, and nausea and vomiting. He stated that he had lost about 15 pounds in weight, and suffered from a feeling of weakness and languor. The general physical examination was negative, except that palpation of the abdomen revealed more rigidity in the left flank than the right. The left kidney appeared to be larger than the right and more tender.

The external genitalia were negative. The prostate gland and seminal vesicles were found normal on rectal palpation.

Urine: The two-glass test showed both glasses soiled with blood. Urinalysis: Bloody, acid, albumin 2 plus, sugar 0, casts 0. Microscopic examination: urine loaded with red blood-cells.

Blood-pressure 138/70. Hemoglobin 75 per cent., red blood-cells 4,300,000, white blood-cells 7000. Wassermann test negative.

Blood chemistry: Urea 13.5, uric acid 4.0, creatinin 1.4, non-protein nitrogen 35.0, CO_2 volumes per cent. 62.

Cystoscopic examination: The bladder appeared normal except that the left ureteral orifice was bulging due to the pressure of a blood-clot, upon removal of which blood was discharged.

The ureters were catheterized each taking a No. 6 shadowgraph catheter to the kidney. Clear urine was collected from the right side and what appeared to be blood from the left.

Phenolsulphonephthalein injected intravenously appeared on the right side in three minutes. None obtained on the left side. Twenty per cent. of the dye was collected from the right kidney in the first fifteen minutes, 10 per cent. in the second fifteen minutes.

The cultures of urine from the right kidney and bladder showed no growth.

The right pyelogram was normal. The left showed a filling defect of the pelvis with some narrowing and elongation of the calices. The outline of the left kidney was larger than the right (Fig. 156).

x-Ray of the chest was negative.

A preoperative diagnosis of tumor of the left kidney (probably beginning in the pelvis) was made in this case, based on the following points: The history of intermittent attacks of hematuria, pain in the left flank, enlargement of the left kidney on palpation, and nausea and vomiting (a rather common symptom in many renal lesions), the finding of blood coming from the left ureter on cystoscopic examination, loss of function of the left kidney, and the rather characteristic findings of tumor shown in the left pyelogram.

A left oblique lumbar incision was made and revealed a large irregular kidney which was removed with the perirenal fat.

Pathological report: A tumor of the kidney which involved almost the entire organ. Grossly a carcinoma of the kidney.

Microscopic examination: Papillary carcinoma beginning in the renal pelvis. Comment: This case gave the rather characteristic history and findings of tumor of the kidney. Hematuria was the first sign, and should have led to a diagnosis when first discovered. The nephrectomy was followed by deep *x*-ray therapy.

Case II. Bilateral Renal Tuberculosis.—A male, forty-six years of age, stated that six or seven years ago he noticed blood in

Fig. 156.—Case I. Pyelogram showing filling defect of left renal pelvis, due to tumor of pelvis.

his urine. He consulted a doctor, who prescribed some medicine, and after a few days the bleeding gradually subsided. Three years later, while riding on a train, he again noticed that the urine was red. This continued for about a week and gradually cleared up. During the last two months he had some pain and tenderness in the lumbar region on both sides, also some frequency of

urination with dysuria. The left testicle and epididymis were removed, as was the right epididymis many years ago. He thinks the diagnosis was tuberculosis.

The physical examination of the chest was negative, as was also the *x*-ray findings. The abdomen was negative except for a slight tenderness in each flank. Urine: Two-glass test, both cloudy. Urine red, acid, albumin 1 plus, sugar 0, no casts. Microscopic examination: Acid-fast bacilli found. Blood: Hemoglobin 80, red blood-cells 4,200,000, white blood-cells 9200. Wassermann negative.

Rectal examination: The prostate was small, the vesicles were hard and somewhat nodular.

Cystoscopic examination: The bladder was injected throughout, cystitis 2 plus. No ulcerations or tubercles seen. The ureteral orifices were not gaping or retracted.

The ureters were catheterized and urine collected for study.

	Bladder.	Right kidney.	Left kidney.
Cell-count:	90	510	300
Culture.....	Bacillus coli.	Bacillus coli.	Bacillus coli.
Smears.....	Acid-fast bacilli.	No acid-fast bacilli.	No acid-fast bacilli.
Guinea-pigs..	Positive for tuberculosis.	Positive for tuberculosis.	Positive for tuberculosis.

x-Ray of the urinary tract failed to show any changes. Pyelograms were not made.

Comment: The diagnosis of bilateral renal tuberculosis associated with genital tuberculosis was quite evident. But here again hematuria was the first sign, and preceded all others by two years. Whether this condition began in the genital tract and involved the urinary tract secondarily or whether it was primary in one kidney would be difficult to state. However, this case again emphasizes the importance of following up the sign hematuria.

Case III. Tumor of the Bladder.—This patient, who was seventy-one years old, stated on admission that she had had blood in her urine intermittently for five years. When it first appeared she consulted a doctor, who looked at her urine and

gave her some medicine. The blood disappeared a few days later, only to return in about three months. The hematuria has recurred many times during the last five years. She consulted the same doctor a number of times and thinks that the medicine he gave her cleared up the urine sometimes.

She decided to come to the hospital for treatment at this time because the doctor died, and she could not get any more of the magic medicine. She stated also that for the last few months she had been troubled with frequent painful urination, and that voiding had been getting more and more difficult. The general physical examination was negative except some tenderness on deep pressure just above the pubis.

Pelvic and rectal examinations were negative.

Urine: Red, alkaline, albumin 2 plus, sugar 0, many red blood-cells.

Culture: Streptococcus viridans. Blood: Red blood-cells 4,100,000; hemoglobin 80. White blood-cells 9800. Wassermann negative.

Cystoscopic examination revealed a large tumor which involved two-thirds of the posterior and right lateral walls of the bladder. The pedicle could not be seen owing to the size of the tumor. There were areas of necrosis on the surface of the tumor. *x*-Ray failed to show any bone metastasis.

Preoperative diagnosis: Papillary carcinoma of bladder. It was quite obvious that this tumor and bladder wall could not be resected so a suprapubic cystotomy was made exposing the tumor which was coagulated with the high-frequency current. The patient died from a pulmonary embolus three weeks after operation.

Comment: This unfortunate old lady had a danger sign (hematuria) which appeared five years before the diagnosis was made. Had she been subjected to a thorough examination with cystoscopy when the hematuria was first seen, in all probability a small (possibly benign) growth would have been found which might have been destroyed by fulguration through a cystoscope.

Case IV. Calculous Pyonephrosis.—A woman aged forty-

eight stated that she had noticed blood in her urine intermittently for the past two years. For the past eight months these attacks of hematuria had been accompanied with pain in the region of the left flank. Four months ago she met with an accident for which an *x*-ray was taken to ascertain whether she had fractured some of her ribs. In this film, shadows were noted in the region of the left kidney (Fig. 157).

Fig. 157.—Case IV. Ram's-horn calculus nearly filling the pelvis and calyces of the left kidney (plain film).

Six weeks ago she had a chill which was followed by temperature and nausea and vomiting. She had had some rise of temperature every day since this time, and frequency had disturbed her both day and night.

Physical examination revealed a marked tenderness in the region of her left flank. There was increased rigidity and the left kidney appeared to be enlarged.

Urine: Cloudy, acid, albumin 1 plus, no sugar. Bladder urine showed 2680 cells. Culture: Eberthella group. The phthalein output from the right kidney was 40 per cent. in one hour, and a scant amount of the dye was secreted from the left kidney. Blood: Red blood-cells 5,000,000; white blood-cells 11,500; hemoglobin 85 per cent. Wassermann test negative.

Fig. 158.—Case IV. Pyelogram of left kidney containing a ram's-horn calculus, showing destruction of renal parenchyma by stone.

The pyelogram of the left kidney (Fig. 158) showed a large stone which occupied the pelvis and extended into all the calices. The pelvis and calices were markedly dilated. From the findings we could conclude that we were dealing with a calculous pyonephrosis in which the function of the kidney had been almost entirely lost. On exposing the kidney it was found enlarged, and appeared to be a sack containing a large ram's-horn stone. The kidney was removed and examination of the split organ

showed little remaining parenchyma. The stone was surrounded by cavities containing pus.

Comment.—In this case again the early sign was hematuria, which appeared two years before the diagnosis was made. An early study of this case might have brought her to operation before the stone had destroyed the kidney.

CLINIC OF DR. RALPH BOERNE BETTMAN

MICHAEL REESE HOSPITAL

TUBERCULOSIS—CAVITY—PNEUMOLYSIS

THE first patient I have chosen for clinic today presents an interesting procedure in the treatment of pulmonary tuberculosis.

This patient, who is twenty years old, was told he had tuberculosis about two years ago. At that time he consulted a physician for loss of weight, cough, and hemoptysis. He was sent to a sanatorium and treated there under excellent sanatorium régime, and improved enough to be able to go back to light duty.

The boy's conception of light work differed materially from what most of us mean by that term, and he took a position entailing not only the greatest of physical labor, but also constant exposure to the elements. Within a month he was again feeling tired, having night-sweats, losing weight, and had a hemorrhage which was mild, but sufficient to make him realize that he required treatment.

He returned to the sanatorium. A physical examination at this time showed activity and a cavity in the upper lobe of the right lung. The left lung was normal. His sputum was loaded with tubercle bacilli, and he had a constant afternoon rise in temperature. Even with thorough rest, very little improvement was made. Following artificial pneumothorax treatment, he improved. His afternoon temperature was lower, he started gaining weight, his cough was less aggravating. However, after three or four months, the improvement ceased, and for the last three months he has been at a standstill, with a slight persistent afternoon fever, a slight but persistent cough, sputum loaded with tubercle bacilli, and occasionally blood streaked. *x*-Ray ex-

amination at this time showed that adhesions which extended from the lateral chest wall to the lung, were holding open a cavity a little smaller than a golf ball. The left lung field was clear. Inasmuch as he was still in the sanatorium, and under practically complete rest, there were no symptoms present except for the cough.

It was evident that as long as the cavity remained open, no further improvement could be hoped for. The fundamental principles underlying pathologic changes are, as a rule, the same, whether these pathologic changes occur in one part of the body or another. The principle holds true that an unobliterated cavity which has been infected continues to be infected as long as a cavity is present. We know now that the cure of an osteomyelitis occurs only when the osteomyelitic cavity is obliterated. We know now that a case of empyema is not cured until the empyema cavity has become obliterated; and we know also, that no case of cavitation of the lung becomes symptomless until that cavity has closed, either by the contraction of the lung, the contraction of the cavity wall due to the scar tissue, or the ingrowth into the cavity itself of granulations and scar tissue.

It therefore seemed a logical conclusion in this case that were the cavity allowed to collapse, the symptoms and physical signs might subside. For this reason the boy was sent into the hospital. Two methods could be used to effect this collapse. The first was the severance of the adhesion, pneumolysis, and the continuation of the artificial pneumothorax. The second was an extrapleural thoracoplasty, which meant the resection of portions of the ribs, allowing the chest wall on that side to sink inward, and in that way overcoming the effect of the adhesion. This particular case seemed especially suited for pneumolysis. The presence of the cavity was responsible for the continuance of the condition. Were the cavity obliterated if only for a few months, it seemed logical to expect that healing would take place. Pneumolysis is a less radical procedure than extrapleural thoracoplasty, and if not successful, can be followed by that more radical operation. In the usual case, in which the activity is not maintained by any one particular cavity in the

lung, pneumolysis is unsuccessful, and artificial pneumothorax is succeeded by extrapleural thoracoplasty.

Pneumolysis can be performed by two methods. The first is the method of Jacobeus. This consists of placing an instrument, somewhat similar to the cystoscope, through an intercostal stab wound into the pleura cavity, observing the adhesion, and then with the electric cautery, introduced either through the same or a similar instrument, severing the adhesion. The second method consists of a long intercostal incision into the thoracic cavity, forcing the ribs apart with the rib spreader, and then under direct vision, severing the adhesion with either knife or a cautery.

The chief advantage of the second method is that the adhesion is severed under direct vision. Any large blood-vessels lying in the adhesions can be caught with a hemostat and ligated in exactly the same way as we would ligate one of the mesenteric vessels in doing a resection of the intestines. The method is simple technically and safe.

Just before the operation the patient was given another pneumothorax treatment. The pressure was raised from −4 to almost 0. This was done to prevent any shock which might result from the wide open pneumothorax during the operation. On the morning of the operation he was given a hypodermic of morphin. The fourth intercostal space was infiltrated with ½ of 1 per cent. procain solution. The second, third, fourth, fifth, and sixth intercostal nerves were blocked by paravertebral injections. The boy was placed on the operating table in left lateral decubitus. An incision was made in the fourth interspace extending from the midscapular line posteriorly to the anterior axillary line anteriorly. It was of interest to note that there was practically no shock whatsoever as the pleural cavity was opened. The wound was spread with a rib spreader.

The adhesions which held the upper lobe were transluminated by means of an electric light. Running through one of these adhesions was a vein the size of a slate pencil. The presence of the view is of particular interest in reference to the Jacobeus method of pneumolysis. A vein of this size would most surely have bled had the cautery been relied upon as the sole method of

hemostasis. By performing the operation the way we did we were able to see the vein, clamp it, and sever the adhesions between clamps and then ligate the severed ends with catgut. Thus absolute hemostasis was assured. The adhesions were severed through their thinnest portion and somewhere about midway between the chest wall and the lung. The actual severance of the adhesion was performed by means of the endothermic knife. If the adhesions are severed too close to the lung prolongations of lung tissue which frequently extend into the adhesion are apt to be cut, thus markedly increasing the danger of infection. If the adhesions are cut too close to the chest wall, the procedure is apt to be very painful, unless the adhesions have been infiltrated with novocain. The advantage of using the endothermic knife, lies in the fact that the bleeding of small oozing surfaces can be controlled by sparking these areas and that if lung tissue is cut through, the raw surface can be sealed by coagulation. Another advantage of the endothermic knife is that the cut surfaces are sterile, thus reducing almost to nil the danger of infection. In the case of this boy it was necessary in three different instances to clamp blood-vessels running in the adhesions. The adhesion at the posterior aspect of the upper lobe of the lung was fairly broad, measuring about 1 cm. in diameter. In this adhesion there were, luckily, no large blood-vessels, but there was an oozing surface which was controlled by sparking.

After the severance of the two string-like and one broad adhesion, the upper lobe dropped away from the chest wall, and lay against the mediastinum, collapsed almost as much as the two lower lobes. A stab wound was then made in the scapular line one interspace above the diaphragm and through this stab wound a No. 20 Petzar catheter was inserted into the chest wound. The end of the Petzar catheter was clamped. Three sutures of heavy catgut were then placed through the intercostal space above the original incision emerging from the intercostal space below the incision. The rib spreader was removed and the sutures were drawn tight, thus approximating the ribs above and below the incision, and practically closing the chest wound. The muscles were then sutured with a running catgut stitch; subcu-

taneous tissue was sutured, and then the skin tightly closed with silk. In order that the pneumothorax in the right chest cavity should be preserved, the clamp was taken from the open end of the Petzar catheter and the patient told to take a deep breath. Air was thus allowed to rush into the pleural cavity, and at the height of the inspiration the clamp was reapplied. In this way we were sure that a sufficient pneumothorax remained.

After the boy was brought back to his room a long tubing was hooked up to the catheter. This tubing extended over the bed and led into a bottle of water placed on the floor at the head of the bed. The end of the tubing was at least 6 inches below the water line. In this way secretions could drain out from the thoracic cavity, but air could not enter, thus maintaining the pneumothorax as a closed and not an open wound.

The convalescence was uneventful. During the first and second day after the operation there was a slight rise of temperature up to 100° F. The drainage was very slight, not more than 3 or 4 ounces of serosanguineous fluid the first three or four days, and after that practically nothing. At the end of the fifth day, the Petzar catheter was removed, the skin at the site of the stab wound was closed with two clips.

I think that the drainage of the chest was unnecessary and in subsequent cases I have omitted it.

The boy was allowed up after a week, and was sent back to the sanatorium at the end of two weeks. His improvement has been marked. He looks well and feels well. His cough is practically stopped. The last positive sputum obtained was two weeks after the operation. Since then, over eight months now, not only have no tubercle bacilli been found, but there is practically no sputum. The pneumothorax has, of course, been maintained by refills about every three or four weeks. It is of interest that recent *x*-rays show that the adhesions have again begun to form between the chest wall and upper lobe of the lung. These adhesions, however, are short, situated near the midline, and will not extend the lung to anywhere near the amount that it previously had been extended. It is logical to expect that adhesions will reform after pneumolysis, perhaps even quicker than the

original adhesions had formed. However, the five to six months collapse of the cavity was sufficient in this case, to cause the cavity to heal, and the slight re-expansion of the lung is evidently not detrimental.

The method of treatment will not be feasible in the majority of cases. However, in those cases in which only a temporary collapse is necessary, this method will prove to be most satisfactory. It is greatly to be preferred to an extrapleural thoracoplasty, not only because it is less extensive and disfiguring, but especially because after the case is healed the affected lung can again become useful.

LUNG ABSCESS—PHRENICECTOMY—CAUTERY LOBECTOMY

THE second case demonstrates many interesting points in the diagnosis and treatment of pulmonary abscess and bronchiectasis not due to tuberculosis.

About three years ago the patient had what he claims was a right sided pneumonia. He says he was very sick for many weeks, and that he has been ailing ever since. He had a chronic cough, which was worse in the morning, but which at any time during the day or night was apt to rack his body. The sputum which he brought up was copious, from 20 to 40 ounces a day. It became hideously foul smelling. None of his friends could stand the odor and he soon became a social outcast. He worked on his farm that summer and fall, but the next winter was again in the hospital. His condition must have been most pitiable, he had lost about 65 pounds, his cough was almost incessant, and the odor of his sputum was extremely foul. At the hospital he was told he had tuberculosis and was advised to go out west. He scraped together his savings, and went. He evidently fell into the hands of some very kind individuals who took pity on him and cared for him well. He improved slightly, he gained a little weight, and his sputum became a little less malodorous. He consulted several physicians some of them telling him he did not have tuberculosis, others insisting that he did have. Of one thing, he is sure, and that is that at no time were tubercle bacilli found in his sputum. Finally after about a year, failing to improve in health, beyond the first slight gain, he returned to his native town. His condition on his return was very much the same as when he left for the west. He again started to make the rounds of the physicians, was again told he had tuberculosis, and finally sent to a tuberculosis sanatorium. Here for the first time he received a skillful examination. The diagnosis of multiple lung abscesses and bronchiectasis of the right lower lobe of the lung of a non-tuberculous nature, was made. He was put on

régime of rest, good food, and postural drainage. Artificial pneumothorax was attempted, but discarded because of the numerous adhesions which bound the lower lobe of the lung, firmly to the diaphragm and chest wall.

When after two months only very slight improvement was made, he was referred to me for operation.

The positive findings when he entered Michael Reese Hospital, about nine months ago, were as follows: The patient was extremely emaciated. He had paroxysms of coughing. His sputum was profuse, from 20 to 30 ounces in twenty-four hours. The odor of the sick-room was offensive. He had marked clubbing of the fingers. Examination of his chest revealed an impairment in percussion note at the lower right base posteriorly. Over this area the breath sounds were at times harsh, at times there was tubular breathing, at times moist râles were heard, but all in all the most striking feature of the examination was the scarcity rather than the presence of physical findings. These are the usual, rather than the unusual findings in bronchiectasis. The symptoms and the x-ray findings are usually strikingly marked in comparison to the physical findings.

His temperature varied, ranging from normal to 101° F. His white blood-count was 10,000 with about a normal differential count. His hemoglobin was about 65 per cent., and his red blood-cell count below 4,000,000. His urine showed a trace of albumin, and an occasional hyaline cast. Never were tubercle bacilli found in the sputum. Innumerable saprophytic organisms were found. At times the sputum was blood streaked. The roentgenogram of his chest showed a definite opacity in the lower right lung field. The diaphragm was irregular as if pulled by adhesions. The apices were clear and the left lung field was clear; a bronchoscopic examination showed purulent material rolling from the right side, none from the left. Instillation of lipiodol into the right main bronchus resulted in the lipiodol finding its way into numerous grape-like clusters in the region of right lower lobe.

The diagnosis of multiple cavities of the lower lobe of the right lung was definite.

There is no reason why this diagnosis should not have been made earlier in this patient's illness. Let me impress upon you two things. The first is that no case of tuberculosis with symptoms as active as those described by this man goes on for day after day, week after week, without at some time or other having tubercle bacilli in the sputum. We know that certain cases of pulmonary tuberculosis may go for long times with so-called negative sputum, but those cases do not present the destructive symptoms shown here. This point alone, that is the persistent absence of tubercle bacilli, should have been more thoroughly appreciated. Furthermore, tuberculosis is a disease primarily of the apices and although a basal lesion may well be caused by tuberculosis, it is more commonly a non-tuberculous affair. Cases of tuberculosis with cavity may have foul, sickening malodorous sputum. But a prolonged fetid sputum, especially without any large single cavities being found in the lung, is more apt to come from a non-tuberculous lesion. Clubbing of the fingers is not, as has often been taught, a sign of tuberculosis. It is a sign of chronic pulmonary disease, may be tuberculosis, but often not.

Allow me to repeat a few of the salient features in the diagnosis of this case even at the peril of repetition.

This patient had a chronic cough, productive, with sputum occasionally blood streaked, he had lost weight, he was weakened, he had night-sweats, he had clubbed fingers, but his lesion was in the lower lung and in spite of the stormy course *he never had tubercle bacilli in his sputum*. The diagnosis is persistent multiple cavities of the lung not due to tuberculosis.

The treatment which he had received at the sanatorium just before his admission to the hospital, consisted of rest, proper food, postural drainage, and an attempt at artificial pneumothorax. He had also received injections of arsenic in the form of salvarsan and sodium cacodylate. This sums up the entire effective non-operative method of treatment.

Surgically three things can be done. The affected lung can be partially immobilized by paralyzing the diaphragm, second, the abscess cavities can be drained, and the pathologic lung tissue removed and, third, the lung tissue can be further immo-

bilized and the cavities more or less obliterated by changing the contour of the chest wall so that the lung will be squeezed as it were between the chest wall and the mediastinum. The paralysis of the diaphragm is accomplished through the operation of phrenicectomy. The ablation of the affected lung tissue by "cautery lobectomy," and the obliteration of the cavities through collapsing the lung by extrapleural thoracoplasty.

I decided in this case to perform the phrenicectomy first, and then follow it with a cautery lobectomy. I did not consider an extrapleural thoracoplasty because I thought that the walls of the numerous cavities would be so thickened that the cavities for the most part, would remain patent, even though I did remove segments of ribs and did allow the chest wall to sink in.

The operation of phrenicectomy was performed under local anesthesia. Through a small incision over the right clavicle the phrenic nerve was exposed where it crossed over the scalenus anticus muscle, it was grasped with a hemostat, cut, and about 4 inches of the distal portion evulsed by winding the nerve slowly on an artery forceps.

Immediately after the operation the patient was examined under the fluoroscope, and it was found that the right diaphragm was slightly higher than the left, and that on inspiration it was sucked upward into the chest cavity, while the left side descended as normally. This paradoxical see-saw motion of the diaphragm which is seen after phrenicectomy is very slight. To all intents and purposes the diaphragm remains stationary and thus the lung immediately adjacent, especially in presence of adhesions, is partially immobile. The only symptom following phrenicectomy is "that the cough is much easier." The disappearance of much of the pain in coughing is due to the fact that the spasm of the diaphragm is done away with.

A week later I performed the first of the numerous stages of the operation of cautery lobectomy. I turned up a flap of skin and resected a portion of the tenth, ninth, and eighth ribs overlying the lower lobe of the right lung posteriorly. After making certain that the pleural space was obliterated by adhesions, I removed a large square of parietal pleura exposing the lung. With

a red-hot cautery I destroyed some of the underlying lung tissue. Dressings were applied and the patient removed to his room. A few days later, at the bedside and without any anesthesia whatsoever, because the lung tissue itself is insensitive to pain, I cauterized still more of the tissue of the lower lobe. This process was repeated at frequent irregular intervals. Thus, little by little, more and more lung tissue was destroyed until I had removed a large portion of the lower lobe of the right lung. There was no shock, there was very little reaction, practically no hemorrhage.

With careful wound dressing and with exposure to ultraviolet radiation (I think this last helps, although I cannot prove it) the wound granulated well.

A month after his admission to the hospital he was sent back to his sanatorium. At that time his sputum was less than 4 ounces a day, and not as offensive as before. The wound in his back was smaller than the palm of my hand, although still pretty deep. There was a fairly free discharge and the openings of three large bronchi could be seen.

A few weeks ago, slightly over six months since his discharge from the hospital, I took a trip to the nearby city from which this patient was referred to me, called upon him, and I found him working in the garden as one of the gardeners in the sanatorium truck farm. He was looking so well that I immediately requested the medical superintendent to allow him to come to Chicago so that I could show him to you today.

As you see he is apparently in good health. The clubbing of his fingers remains. He has gained back 45 of the 65 pounds he had lost. He coughs only occasionally, and his total sputum is never over 2 ounces a day, usually less, and some days he has no sputum. What sputum remains has a slightly unpleasant odor, but not the foul odor it originally had. He is able to mingle with his fellow men again, eat with them at the table, sit around at cards, and in short, enjoy normal social intercourse.

On his neck you can see the thin scar of the phrenicectomy operation. When he takes off his shirt you can see that the lower right chest is flatter than the lower left, and that the motions of

respiration are less. Here you see the large scar of the lobectomy operation puckering in from all sides to this little area in the middle of which is the opening of a bronchial fistula, and from which a thin mucilaginous discharge is coming. If he closes his mouth and holds his nose and then makes a forced expiration, you can hear the air being forced out of this fistula, and if I hold a lighted match near it and tell him to repeat the maneuvre, the match as you see is extinguished. Naturally he can never immerse himself in water above the level of this fistula. Perhaps some day or other we will attempt to close it for him. However, for the time being, we and he are well satisfied with the result.

This case can be summed up as follows: A middle aged man, following an acute pulmonary infection develops all the classical signs of pulmonary tuberculosis plus the symptom of profuse foul smelling expectoration. The pathologic condition gives few signs on physical examination, but on bronchoscopic and roentgenologic study, it is found that a widespread lesion exists at the right base. At no time are tubercle bacilli found in the sputum. The diagnosis of tuberculosis is proved to be wrong and the correct diagnosis of multiple chronic lung abscesses and bronchiectasis is made. The medical treatment consists of rest, careful hygiene, postural drainage, and arsenic injections. Artificial pneumothorax is attempted. No improvement being made, surgery is resorted to. Surgery consists in stabilizing the affected part of the lung by paralyzing the diaphragm and then later, by removing as much as possible of the pathologic tissue. The man makes a speedy and dramatic recovery.

CLINIC OF DR. BERNARD PARKER MULLEN

PRESBYTERIAN HOSPITAL

PROGRESS OF SUBPHRENIC ABSCESS FOLLOWED BY LIPIODOL INJECTIONS. CASE REPORT

THIS patient, male, age forty-eight and white, case 223,138, was first seen April 10, 1928. He was acutely ill. His complaints at the time were: (1) Pain in the abdomen, twenty years' duration; (2) belching; (3) clay-colored stools; (4) scanty, dark-colored urine. The history obtained at that time was as follows:

Onset and Course.—The patient's symptoms started twenty years ago as an indefinite distress in abdomen, associated with nausea, vomiting, and considerable belching. At this time he noticed that his stools were clay-colored, and urine dark. Since then he has had many similar attacks at intervals of three months to one and a half years. They were usually quite mild with the exception of one attack which was quite severe and resembled his present trouble.

Past History.—Negative except for appendectomy sixteen years ago, performed to relieve the symptoms described above.

Present Attack.—Patient had severe pain in right hypochrondrium radiating around abdomen and to the right scapular region; it had been present forty-eight hours.

Physical Findings.—Patient's skin was moist, hot, but not jaundiced, and he was very restless. There was a point of tenderness over the gall-bladder. Rigidity was not marked and was localized to the tender point. There was a tympanitic area between the liver dulness and the lung resonance anteriorly. His pulse was 112, temperature 100.4° F., white count 24,900.

Fluoroscopy with patient sitting showed the left diaphragm to be normal; the right was high and moved little, if at all, with respiration. *x*-Ray plates showed the extreme right costal angle

of diaphragm to be curved slightly upward. A fluid level was found 1½ inches below the diaphragm with an area of lessened density just above it.

Fig. 159.—Lipiodol injection in subphrenic abscess thirteen days following drainage.

Fig. 160.—Lipiodol injection in subphrenic abscess twenty-two days following previous injection.

These findings are so characteristic of a subphrenic abscess that immediate operation was advised. Patient was, therefore,

sent to the operating room and a number of attempts were made to locate the abscess by inserting an aspirating needle between the pleural and peritoneal reflections, but without success. Finally the needle was inserted in the eighth interspace in the anterior and axillary line over an edematous area of the skin, and pus was found in the right anterior subphrenic space. With a needle *in situ*, the parietal pleura was exposed and accidentally opened. Immediately the diaphragm was grasped and sutured to the pleura without rib resection and about the aspirating needle. The suture line was made air tight, the needle was removed, and the incision packed with iodoform gauze. The intention was to leave one pack in place for forty-eight hours, but the following morning, the white count had increased to 40,200 and it was decided to open the abscess immediately. This was accomplished under local anesthesia by incising the diaphragm within the sutured area. Considerable thin purulent material drained and a rubber tube was inserted. The same day the white count dropped to 41,400 and the patient seemed greatly relieved.

On the thirteenth day following the operation lipiodol was injected into the tract and *x*-ray plates taken. A blunt glass syringe was used for this purpose, the solution being warmed first and held under pressure until pictures were taken. On removing the syringe most of the solution immediately drained off. The *x*-ray plates showed a dense, narrow, elliptical shadow 12 cm. long and 2.5 cm. wide, following the curve of the diaphragm, and seeming to originate at the lower margin of the liver in the region of the gall-bladder. The diaphragm was still very high. The abscess continued to drain for twenty-two more days, at the end of which time there was a second injection of lipiodol and *x*-ray plates were taken. The latter showed the abscess cavity much smaller than in the previous film.

The patient was sent home May 24, 1928 still draining a little. The tube came out ten days later and the patient made an uneventful recovery.

On July 30, 1928 the patient returned to the hospital feeling better than he had for twenty years. The purpose of his return was to determine more accurately the source of his abscess.

Stomach analyses were normal and there was no retention of a seven hour motor meal. Fluoroscopy showed the right diaphragm still slightly elevated. The stomach filled well and emptied normally. Good waves were seen closing off to the end of the antrum. The duodenal cap was irregularly deformed, not by the usual configuration seen in duodenal ulcer, but resembling adhesions to some other structure. The white count was 9600. Cholecystograms were taken following intravenous injection of sodium tetraiodophenolphthalein. No dye was demonstrated in the gall-bladder in any of these films.

The appendix having been previously removed, the bulk of evidence seemed to point to the gall-bladder as the source of trouble, and it was thought that recurrence of his trouble was reasonably certain. With this in mind, an exploratory operation was performed. Numerous, dense adhesions were found between the abdominal wall, omentum, duodenum, stomach, gall-bladder, and under surface of liver. These were carefully separated and the gall-bladder, bile-ducts; and stomach were found to be normal. On the anterior surface of the duodenum was a stellate scar, evidence of a perforated duodenal ulcer which had healed. There was no evidence of obstruction. Inasmuch as the motor meal and fluoroscopy had shown no obstruction at the stomach outlet, and that just prior to operation the patient had felt better than he had since his trouble began twenty years ago, his abdomen was closed without further operative procedure. He was placed on ulcer management and sent home August 26, 1928. He is now working and in good health.

The points of interest in this case are: (1) Although the abscess was drained through the pleural cavity, no pleural contamination occurred; (2) the history was misleading in that it resembled gall-bladder disease; this was probably due to the fact that the duodenum had long been adherent to the gall-bladder about the ulcer; (3) the usual interpretation following intravenous injection of the sodium tetraiodophenolphthalein dye would indicate gall-bladder disease in this case; however, on exploration the gall-bladder and bile-duct seemed normal in every way. The dense adhesions about these structures evidently

caused by the perforated ulcer, may have produced sufficient obstruction to the cystic ducts to prevent gall-bladder filling.

Summary.—The great majority of subphrenic abscesses drained in this manner are complicated by empyema. The success in this case may have been due to the fact that rib resection was not resorted to, but chiefly to a two-stage operation with accurate suture of the pleura, together with an iodoform gauze pack in the incision.

The use of lipiodol as a diagnostic measure is a harmless procedure if excessive pressure is avoided and sufficient time is allowed for the abscess to wall-off. This helps to solve the problem of when to remove the drain. Its use in this manner has been reported.[1]

[1] Castex, M. R., Romano, N., and Gonzales, H.: Radiologic Exploration of Subphrenic Pyopneumocyst by Injection of Lipiodol, Bull. et mém. soc. méd. d. hop. de Paris, 50, 222–226, February 12, 1926 (illus.); abstr. Jour. Amer. Med. Assoc., 86, 1252, April 17, 1926.

CLINIC OF DR. FREDERICK CHRISTOPHER

EVANSTON HOSPITAL

URETERODURAL ANASTOMOSIS

Case I.—Baby Edward B. aged five months was admitted to the Evanston Hospital on March 12, 1927, with a diagnosis of spina bifida and hydrocephalus. The baby was born at a normal delivery and aside from the present condition there has been no illness. The child was well-nourished and appeared to be of satisfactory mental development. The head was large, measuring 19 inches in circumference. The anterior fontanel measured $5\frac{1}{2}$ by $3\frac{1}{2}$ inches, and was under some tension. In the lumbar region was tumor mass about $3\frac{1}{2}$ inches in diameter and about $2\frac{1}{2}$ inches in height. The surface of this tumor was shiny and pink except for a small superficial area of ulceration at the apex of the convexity. It transilluminated, and on palpation was found to be tense and fluctuating. There was movement in both legs. Temperature and pulse were normal, and the urine was negative.

In view of the hopeless prognosis the operation of ureterodural anastomosis was proposed and accepted. It was felt that the extremely slight chance of benefit which this operation might bring about was a preferable alternative to no operation at all.

On March 16, 1927 operation was performed under ether anesthesia. The dural sac of the spina bifida was dissected away from the skin. Certain nerve filaments originating in the cauda equina were necessarily divided. The usual incision for exposure of the right kidney was made upon the right side, and the redundant isolated dural sac was passed subcutaneously laterally, and out through the kidney incision. The right kidney was then delivered into the incision and was removed taking care to preserve as much as possible of the pelvis of the kidney. By means

of very fine chromic catgut, threaded upon fine needles, the funnel of the kidney pelvis was anastomosed to the dural sac. The incision was closed with silk sutures. At the start of the operation the pulse was 160, but became steadily poorer. Despite hypodermoclysis and camphorated oil the condition became worse, and the baby expired just as the operation was completed. At death it was noted that the fontanels were greatly depressed, doubtless due to the escape of spinal fluid. Postmortem was refused.

Case II.—Baby boy L. was born in the Evanston Hospital on March 4, 1928 after a normal delivery. At birth the baby was found to have a spina bifida with velamentous covering. The spinal canal was not closed and the dura fused with the skin so that the cauda equina could be seen through transparent membranes. There was a complete paralysis of the lower extremities, but control of the bladder and rectum was partially preserved. The baby was placed under the care and observation of Dr. C. A. Aldrich. The feedings were well taken and the child increased in weight. After a few days the spina bifida ruptured, the sac became infected, and the baby developed a meningitis of mild type from which he made an uneventful recovery. Moise[1] has reported a case of staphylococcus meningitis secondary to congenital sacral sinus. The child kept the head retracted, although flexion of the head upon the chest could be accomplished without force. The dural opening upon the back began to epithelize and finally became entirely closed. The tissues of the spina bifida were infected and there was a considerable purulent discharge at times. With the closure of the spina bifida there was an abnormal increase in the size of the head. The hydrocephalus became increasingly marked and the sutures more widely separated, and in view of the extremely unfavorable outlook and because of the urgent importunities of the family that operation be tried even though the likelihood of benefit was extremely remote, an attempt at a uretero dural anastomosis was determined upon. On May 15, 1928 operation was done under

[1] Moise, T. S.: Surg., Gynec., and Obst., 42, 394.

ether anesthesia. The right kidney was removed through the conventional renal incision. The ureter and attached kidney pelvis was passed subcutaneously to sac of the spina bifida. The

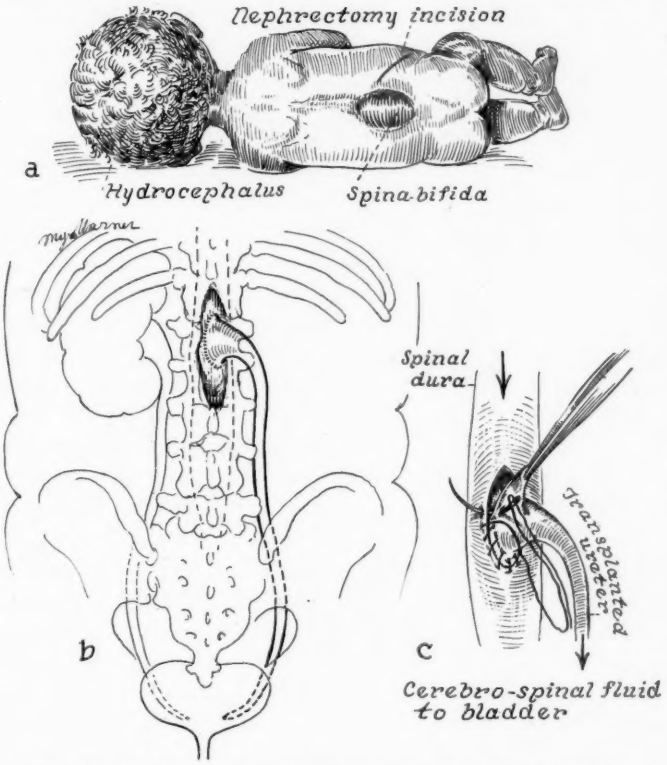

Fig. 161.—Schematic representation of operation of ureterodural anastomosis in cases of hydrocephalus communicating with the dura of the spinal cord. *a*, Situation of the nephrectomy incision in relation to the spina bifida. *b*, The right kidney has been removed and the ureter of the right kidney with its pelvis has been transplanted subcutaneously and attached to the dura of the spinal cord. *c*, Details showing method of anastomosis of the ureter to the dura.

channel beneath the skin was readily made by divulsing with a hemostat. The kidney pelvis was then anastomosed to the dura and the skin was closed in layers (Fig. 161). The operation re-

quired fifty-six minutes and the infant left the table in fair condition. Despite the infection, the wound healed rapidly. On

Fig. 162.—Drawing of the junction of the ureter and the dura in a dog (Heile).

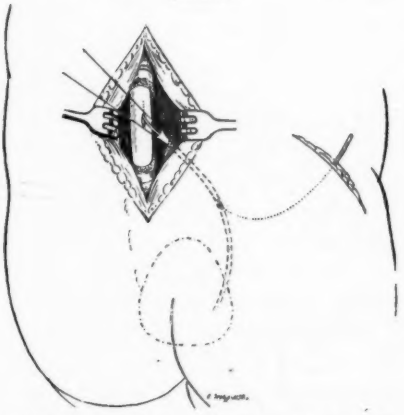

Fig. 163.—The utilization of the ureteral sound to facilitate ureterodural diagnosis (Heile).

June 5, 1928, the anastomosis was revised, and more accurate attachment was obtained. The excess scar tissue of the skin of

the back was removed. The patient did very well after this operation. The feedings were well taken and there was a gain in weight. The head diminished in size and the tension at the fontanels seemed to be less. There was no improvement in the function of the legs; the bladder was always distended and palpable except after urination. The child was discharged from the hospital on June 22, 1928. When seen some two months later the child had gained in weight and appeared to be in excellent general health. The head, however, seemed to have become a little larger. In September, 1928 the condition was as follows: Physically normal except for (1) dilated bladder, (2) paralyzed legs. Mentality is definitely below par: (1) Doesn't respond to normal stimuli (smile, cry, etc.), (2) no attempt to sit up.

In November, 1928 the baby unfortunately showed a definite hydrocephalus. The pediatrician attending the child reported large quantities of pus in the urine. Otherwise the child was in excellent health. The child died with symptoms of excess intercranial pressure in January, 1929.

Numerous operations have been devised to bring about the amelioration of hydrocephalus. Corpus callosum puncture, excision of the choroid plexus, the introduction of a silver tube, or transplants of blood-vessels so as to establish a communication between the dura of the spinal cord and the peritoneal cavity, have all been tried and the results have not been encouraging. The extremely distressing picture presented by these patients has stimulated workers to fresh efforts. Relief of the hydrocephalus by the removal of spinal fluid is only feasible in those cases where the foramen of Magendie is sufficiently patent as to permit the drainage of the excess fluid from the cranium to the spinal canal. Professor B. Heile,[1] of Wiesbaden, experimented with the ureter in dogs and in 1925 reported his first human case. The infant suffered from hydrocephalus which had developed after an operation for spina bifida. There was an intermittent fistula at the site of the spina bifida operation. When the fistula was open the child's condition was satisfactory, but when it healed over there was increasing hydro-

[1] Heile, B.: Centralblatt für Chirurgie, 52, 2229, 1925, No. 4.

cephalus and spasms of the legs. The head increased in circumference as much as 3 cm. in ten days. When as much as 100 c.c. of the spinal fluid was withdrawn the spasms were benefited, but only temporarily. Heile operated under ether anesthesia, using only some 30 drops for the entire operation. A laminectomy was first done immediately above the site of the spina bifida repair. The left kidney was then delivered into the wound and the pelvis of the kidney was cut across at its attachment to the kidney. A canal was made through the spinal muscles, and through this canal was drawn the ureter by the flaring funnel of the kidney pelvis to which it was attached. After closure of the retroperitoneal incision the kidney pelvis was then anastomosed to the spinal dura by silk sutures. Exceptionally good results followed. The child developed normally and there were no further convulsions. From Heile's dog experiments he concluded that the anastomosis remained patent and that there was no reaction between the dura and the ureter (Fig. 162). A few months later, Drachter[1] of München, having read Heile's paper, reported that in 1917 he had done a ureterodural anastomosis, but the child had died two days after the operation. Drachter had hoped that if the child had lived that he might have tested the urine for sugar as a means of identifying the spinal fluid. Two years later, Heile,[2] reported that the case mentioned in his previous communication was now four years old and was apparently well, and of satisfactory mental development. Heile had operated upon 8 dogs. Injections of the ureter with contrast media for *x*-ray examination showed that the fluid could be injected into the dural canal. Microscopic sections of the anastomosis showed beautiful healing. Heile described a refinement of technic in which he used a ureteral sound passed up through the ureter and into the dura as an aid to the anastomosis (Fig. 163). This author reports the case of a second child operated upon. In his first paper Heile reported the trial of this operation in the case of a brain tumor in which the spinal fluid was under high tension, but states that the "condition was too grave for more than temporary

[1] Drachter: Centralblatt für Chirurgie, Leipzig, 1925, 52, 2776.
[2] Heile, B.: Ibid., 1927, 54, 1859.

relief," and that the adult patient died upon the day following the operation.

Further experimental and clinical work must be done in an attempt to evaluate this operation. It is only feasible where there is ample communication between the hydrocephalus and the spinal canal. Moreover, it is only justified where the symptoms are increasing and removal of spinal fluid may indicate relief. The sacrifice of a healthy kidney seems to be entirely justifiable if there be any likelihood of success. Where spina bifida is present simultaneously with the hydrocephalus, the operation is not contraindicated, in fact, some of the spina bifida sac may be utilized, as in the writer's Case I. The likelihood of ascending urinary infection causing meningitis is conceivable but improbable because of the peristaltic action of the ureter.

These cases are reported because of their interest. The evidence which they present does not in any case warrant the universal or perhaps even the occasional recommendation of this operation for hydrocephalus.

CONGENITAL RECTOVAGINAL FISTULA

DORIS H., age nine years, was admitted to the Evanston Hospital on September 15, 1926. The child suffered from a congenital rectovaginal fistula which had been subjected to unsuccessful operations at nine months and at eighteen months. The patient was entirely incontinent of feces which were more or less continuously discharged through the vagina in small formed lumps. Because of the odor, school attendance was difficult, if not impossible. The child was but fairly well nourished and of rather poor color. Aside from the fistula and a systolic murmur, the physical examination was negative.

On September 15, 1926 a third attempt at operative correction of the rectovaginal fistula was made. The rectum was dissected free from the vagina, with considerable difficulty owing to the considerable amount of scar tissue caused by the two previous operations. An incision was made in the intact skin just posterior to the vagina and the rectum was sutured circumferentially to the borders of this skin incision, thus creating a new anus. The vaginal wall was closed at the site of the old fistula. A rubber tube in the anus was kept patent by boric irrigations and considerable quantities of fecal material were removed. On the fourth day the entire wound broke down and large quantities of fecal material was discharged through the vagina.

It now seemed evident that there could be no successful plastic work about the rectum until the large bowel was temporarily diverted through a colostomy. Accordingly the child was again admitted to the Evanston Hospital on July 5, 1927, and on the next day a left inguinal colostomy was done. A loop of the descending colon, which was found to be of adult size, was delivered through the wound and sutured to the peritoneum. A glass colostomy tube was introduced into the bowel and made fast by means of a purse-string suture. On July 12th the colostomy opening was revised and enlarged. The descending colon

below the colostomy and the sigmoid flexure were enormously distended and were packed with fecal material, as if the narrow outlet of the fistula had brought about a continual back pressure and dilatation of the colon. It was extremely difficult to empty the bowel between the colostomy and the fistula. Numerous enemata and irrigations were given. Accordingly, on August 2, 1927, the impacted feces was broken up under anesthesia and was irrigated out. By August 13, 1927, the colostomy was functioning well and the child's general condition was improved. On this day a plastic operation was done in which the rectum was sutured to the rim of the new anal opening. A considerable amount of dissection was necessary in the dense scar tissue in order to separate the vagina from the rectum. The fistulous opening in the vagina was closed. The patient made a rapid recovery from this operation and was discharged from the hospital a week after the operation.

Following the colostomy operation and its incident relief from fecal stasis and back pressure, the child's general condition began to improve rapidly, and a marked gain in general health resulted. The child returned to school and grew in stature and made a very considerable gain in health. After the new anal opening had completely healed it was found that the scar contraction had caused it to shrink down so completely that it was only with difficulty that a probe was admitted. The new anus was repeatedly dilated with increasing sizes of bougies from the size of a probe up to the little finger. The earlier of these dilatations were of necessity done under general anesthesia. The mother was then instructed to dilate the rectum with the gloved finger, beginning with the little finger and working up to the thumb. After the thumb size had been attained the child was furnished hard rubber dilators which she passed daily until an ample sized opening was obtained and it was thought safe to make an effort to close the colostomy, and restore the normal course of the alimentary tract. As time progressed there had come about an increasing amount of prolapse through the colostomy opening. About a year after the plastic operation, on August 1, 1928, under gas anesthesia, the prolapse was reduced

and a rubber T-tube was so put in place as to make pressure upon the spur of the colostomy.

On August 15, 1928 the patient was readmitted to the hospital and the rubber T-tube was removed. On August 23, 1928 the colostomy was closed and at the same time a plastic operation was done upon the little finger which had an old burn contracture. The colostomy closure was successful, and fecal material began coming through the new anus. There seemed, however, to be some difficulty in the expression of the feces and

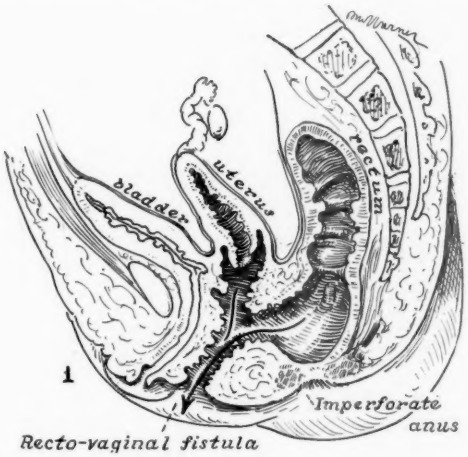

Fig. 164.—Diagram showing condition of case at birth. Anus is imperforate and all the fecal material passes through the rectovaginal fistula and out through the vagina; complete incontinence.

a rectal examination was made. The examining finger passed easily through the anus and entered a smooth blind pouch through the walls of which could be palpated doughy feces. This situation was difficult to explain because fecal material was coming through the anus. An examination under general anesthesia furnished the explanation. It was found that the septum composed of the anterior rectal wall and the posterior vaginal wall had partly sloughed away. A portion of the posterior wall of the vagina had in some manner swung forward as a flap and,

uniting to the vault of the vagina, had completely occluded its orifice. It is not improbable to suppose that the three previous operations had resulted in the formation of so much poorly nourished scar tissue in this region that sloughing became inevitable. It is possible that the dilatation may have contributed to the damage (Figs. 164–166). The spur formed by the unsloughed proximal portion of the rectovaginal septum was so

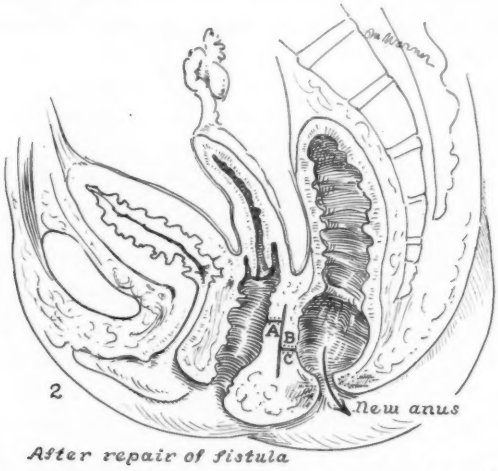

Fig. 165.—Diagram showing condition of patient following fourth operation. Three unsuccessful operations had been done without preliminary colostomy. The fourth and successful operation was done following a left inguinal colostomy. The new anus was constructed by making a buttonhole opening in the proper situation and suturing the rectal mucosa to the skin. The rectovaginal septum was repaired in the manner shown in the diagram. This tissue was composed chiefly of dense scar tissue because the previous operations and dissection were difficult.

long as to interfere with the passage of the feces from the rectum through the new anus. On September 1, 1928, under gas and ether anesthesia, the septum was split backward so as to remedy the difficulty. Following rectal irrigations there was soon ample passage of feces, but imperfect control. The child was discharged from the hospital on September 3, 1928. The child very soon learned to control the new anus, most probably

by contraction of the levator ani muscles. At this time, November 13, 1928, the child has returned to school and is in excellent health. She has regular bowel movements and does not soil herself while at school. While at home, however, her mother says that she still occasionally soils herself slightly. This defect will doubtless be remedied with time and careful attention upon the part of the child.

The child is now eleven years old and will soon begin to menstruate. When menstruation begins the problem is raised

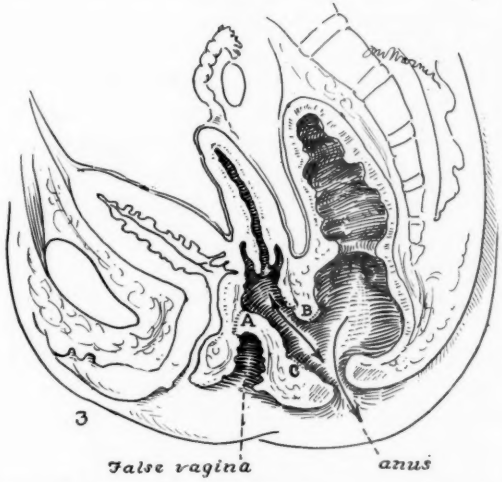

Fig. 166.—Present condition of patient. Because of the poor nutrition of the repaired rectovaginal septum flap *A* has separated and, with the portion *C*, has become attached to the anterior vaginal wall, thus creating an unintentional colpocleisis. The inguinal colostomy has been closed and the entire fecal content is expelled through the new anus. Control of the new anus has been learned by use of the levator ani muscles.

as to whether or not menstruation into the rectum will incur the risk of a colon bacillus endometritis. It seems certain that further plastic work upon the rectovaginal septum would be futile, and that probably the solution of this problem may be the performance of a hysterectomy.

The child has now resumed her place in society, whereas pre-

vious to her series of operations, she was a virtual outcast because of her more or less constant malodorous fecal contamination.

Wharton[1] has epitomized the embryology of the region of the vagina as follows: "The bladder, urethra, and rectum are derived from the cloaca or hindgut and between these cloacal organs the fused Müllerian ducts insinuate their way toward the external genitalia forming the vagina. . . . The cloaca divides into two parts, the anterior part forming the bladder and urethra, and the posterior part, the rectum. Between these halves of the cloaca the Müllerian ducts form the vagina. Evidently congenital fistulæ which occasionally connect the bladder, rectum, and vagina are due to the incomplete division of the cloaca and the persistence of the embryologic opening between them."

Where there is an imperforate anus coincident with the rectovaginal fistula Wharton advises that the operation be performed in two stages. In the first stage the external opening is made, and in the second the fistula is closed. Frequently the closure of the fistula is unattended by great difficulty. The edges of the fistula are denuded and are stitched together. At other times great difficulty may be experienced in the closure. It may be necessary to separate the intestine from the vaginal wall and suture the opening in it directly; it may be necessary to excise the piece of intestine containing the fistula and perform an end-to-end anastomosis. Jellet[2] states that it may be necessary to first make a large rectovaginal fistula and then perform a colpocleisis, thus closing the vaginal outlet, and converting the vagina into a kind of rectal diverticulum.

[1] Wharton, Lawrence, R.: Lewis' Practice of Surgery, vol. x, W. F. Prior Co., Inc., 1928.

[2] Jellet, H.: Practice of Gynecology, Lea & Febiger, 1925, p. 338.

CLINIC OF DR. EDWIN M. MILLER

PRESBYTERIAN HOSPITAL

ACUTE INTESTINAL OBSTRUCTION ASSOCIATED WITH RUPTURED APPENDIX

ORDINARILY a ruptured appendix alone is a serious enough condition, and an acute intestinal obstruction by itself, no matter what its cause, is a problem not always easy to relieve; but when a combination of the two exists at the same time in a child who has been critically ill for several days, we have a situation which may be extremely difficult to solve successfully. During this past summer I have had occasion to deal with two such cases at the Cook County Hospital, both of which made a successful recovery, but in obtaining this result we have gone through experiences, the detailing of which may be of interest to those of you who do abdominal surgery.

Case I.—The first case, a girl of nine years, was brought to the children's ward on June 2, 1928 critically ill. She had taken sick five days before with pain in the lower abdomen, followed by nausea and vomiting. The condition steadily became worse and the vomiting continued. Upon entrance the abdominal distress was severe. The thighs were held in flexion. There was tenderness over the entire lower two-thirds of the abdomen, but most marked in a rather circumscribed area more on the left side. The leukocyte count was 14,100, and the temperature 100.4° F. A diagnosis was made of perforated appendix with an abscess that was localizing on the left side, and conservative management followed. In spite of a large quantity of normal saline beneath the skin the vomiting continued and on the following day, with a leukocyte reaction mounting to 24,000, the pain be-

came intermittent in type, and assumed a somewhat rhythmic character. The rapid appearance of marked peristaltic waves completed the picture, and it was with no hesitation that a diagnosis of intestinal obstruction was made.

Under ether anesthesia a low left rectus incision was made (Fig. 167, 1) in order to reach the center of the definitely localized area of swelling, pain, and tenderness. A fibrinous exudate was everywhere present. Many loops of small bowel were matted together, and in the center of this mass was a ruptured appendix bathed in pus and a fecalith lying free (Fig. 167, 2). Clinically we knew that a mechanical obstruction existed, but it was at first difficult to make out where in all this tangled mass of adherent coils the point of narrowing was to be found. It was necessary, therefore, in spite of the presence of the pus and more or less generalized peritonitis, to proceed radically to untangle the mass, dig out the appendix, and place the ileostomy opening in the dilated loop just above the point of obstruction (Fig. 167, 3 and 4). The extent of involvement was amazing and the widespread distribution of the purulent exudate surprising (even as high as the area about the spleen), all of which added to the apparent hopelessness of the outcome. It was as a matter of last resort, therefore, that before closure was made the entire abdomen was thoroughly irrigated with a large quantity of warm saline solution.

The reaction to operation was surprisingly good. The vomiting at once ceased and the general condition gradually improved. As the days passed by, however, the skin about the opening became intensely red and irritated to a point where, in spite of the best efforts at cleanliness and the faithful use of various soothing applications, the entire area on the front of the abdomen became so fiery red and so intensely painful that the child refused to eat and could scarcely sleep (Fig. 167, 5). Fortunately, the bowel distal to the opening soon began to function and a considerable part of the fecal material passed the normal way, but notwithstanding this she lost many pounds in weight and the situation took on a serious aspect. It occurred to us one day that if we could prevent any of the discharge from coming in contact with

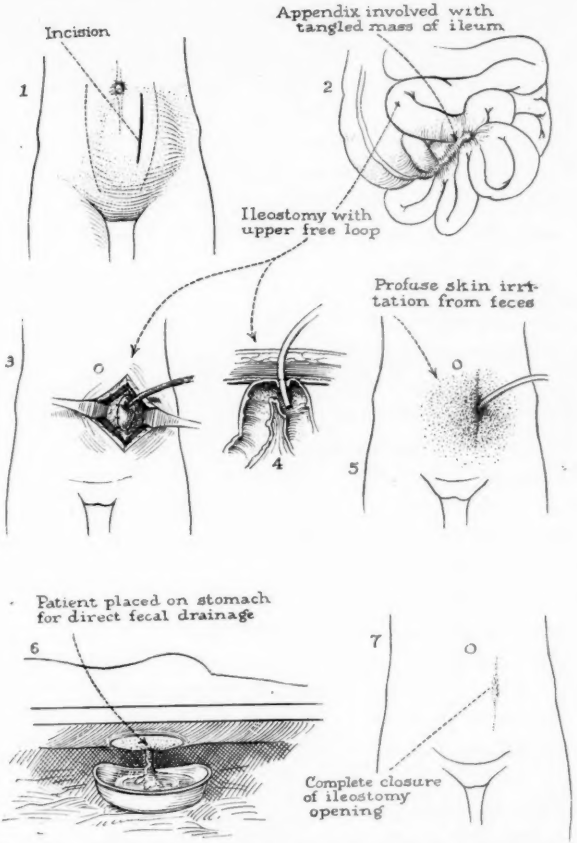

Fig. 167.—Acute intestinal obstruction (mechanical) following ruptured appendix. 1, Incision through left rectus over area of swelling, pain, and tenderness. 2, Several loops of ileum matted together about the abscess producing a mechanical obstruction. Appendix removed. 3 and 4, Ileostomy made in ileum just above the highest loop involved in the adherent mass. 5, Skin over entire abdomen severely irritated from the fecal discharge through the ileostomy. 6, Patient kept face down on Bradford frame so that fecal discharge passed directly into a receptacle. 7, Prompt healing of the skin and spontaneous closure of the ileostomy opening.

the skin surface we might get results, so the child was at once placed upon a Bradford frame and kept there face down without

any dressing, thus allowing the fecal material to pass directly into a receptacle beneath (Fig. 167, 6). The improvement in the skin was rapid and with it the general condition of the child turned for the better. Her pain was relieved, she began to eat, she rapidly put on flesh, and before many days the clinical picture had entirely changed. The skin returned to normal (Fig. 167, 7), the artificial opening spontaneously closed, and today (six months after operation) the little girl is the picture of health.

Case II.—The second case, a boy of three years, was in many respects similar to the first. Before entering the hospital he had been ill for seven days and the clinical picture when first seen was typical of a ruptured appendix with more or less diffuse abdominal findings. The entire abdomen was distended, rigidity was bilateral, and tenderness most marked over the appendix region. As he lay upon the operating table before being put to sleep, one could detect distinct peristaltic waves across the upper abdomen, and the tension of the abdomen seemed to come and go rhythmically, giving us an unmistakable evidence of a mechanical obstructive process.

The abdomen was opened through a right rectus incision (Fig. 168) and almost identically the same situation found as in Case I, no free fecalith, however, being found. The entire mass was untangled, the appendix removed, the obstructed loop located, and ileostomy performed (Fig. 168, 2).

To say that the child's condition was at that time serious is stating the facts mildly, for we felt quite certain he could not survive the procedure. You might with reason ask why under such circumstances do we not leave undisturbed the entire inflammatory area and make a simple opening in any dilated loop which happened to present, perhaps under local anesthesia. My answer to this: First, one can in this way never be certain that the obstruction is relieved, inasmuch as the point of actual mechanical narrowing may be proximal to a loop which through a small incision appears to be dilated; second, the undisturbed loops of inflamed bowel so intimately involved in the mass surrounding the original source of the peritonitis are almost sure to

offer an effective block to the passage of intestinal contents distal to the temporary opening.

The outcome of the procedure was favorable, almost as favor-

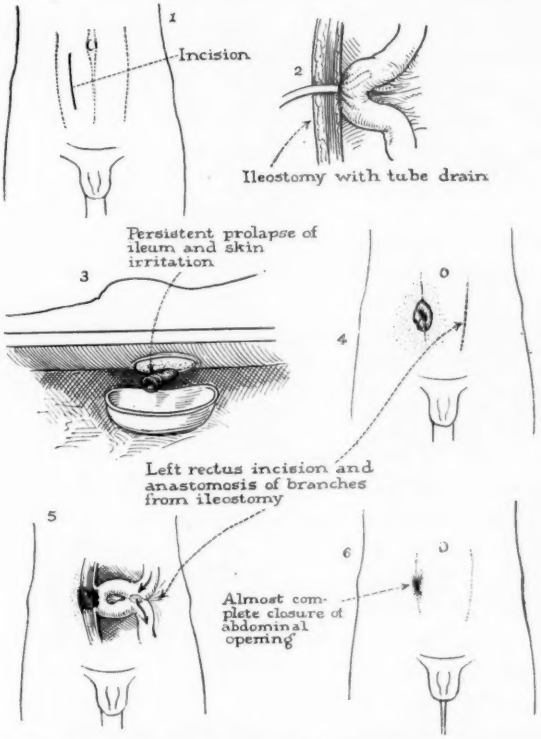

Fig. 168.—Acute intestinal obstruction (mechanical) following ruptured appendix. 1, Right rectus incision over area of most pain and tenderness. 2, Ileostomy made just above the loop mechanically obstructed by the mass of entangled bowel surrounding the ruptured appendix. Appendix removed and bowels disentangled 3, Prolapse of lining when patient kept face down in the attempt to relieve the skin irritation. 4, Left rectus incision through sterile field. 5, Lateral anastomosis between afferent and efferent loops. 6, Spontaneous closure of ileostomy.

able as with our little girl. There proved to be this difference, however: Instead of the normal channel gradually becoming

spontaneously re-established, and the ileostomy spontaneously closing, the channel remained permanently blocked at the fistula, because unintentionally a large rather than a small opening had been made in the bowel through which the mucosa readily prolapsed, especially so when attempt was made to overcome the skin irritation by placing the boy on a Bradford frame face down (Fig. 168, 3). We were forced, therefore, either to close this fistulous opening by operation in spite of the severe condition of the surrounding skin, or to leave the fistula intact and short circuit the loop involved. Under the existing conditions the latter seemed the wise course, and a new incision was therefore made through the left rectus muscle in a clean field (Fig. 168, 4) (the right side being effectively covered). The afferent and efferent loops of the ileostomy were isolated and a lateral anastomosis made between them (Fig. 168, 5). The procedure was effective. There was but little reaction, the incision remained clean, and the fecal current at once began to find its way downward through the once badly matted together coils of bowel. Almost two months have now passed since this was done and not a day without a normal movement of the bowels. In addition, by keeping a firm gauze pad constantly strapped over the old fistulous opening the skin about it has returned to normal, and the opening itself practically closed (Fig. 168, 7).

The clinical results in both of these cases have been gratifying to us, and we hope that those of you who encounter similar situations may profit by our experiences.